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# COMMENTARY

ON THE

# BRITISH PHARMACOPŒIA.

BY

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AQUILLA SMITH, M.D., M.R.I.A.,

FELLOW AND TREASURER OF THE KING AND QUEEN'S COLLEGE OF

PHYSICIANS IN IRELAND, AND REPRESENTATIVE OF THE

COLLEGE ON THE GENERAL MEDICAL COUNCIL,

PROFESSOR OF MATERIA MEDICA IN THE

SCHOOL OF PHYSIC,


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## P R E F A C E .



THE object of the present work is to supply practitioners and students with an explanatory commentary on the drugs and preparations in the British Pharmacopœia.

It will be observed that it differs from other class books on *Materia Medica* in not reprinting the text of the Pharmacopœia, and by the adoption of this course the size of the book is kept within reasonable limits, and needless repetition of the characters given in the B. P. is avoided.

The natural history of the animal and vegetable substances is very briefly dealt with, and details are given of such plants only as are indigenous to Great Britain and Ireland or are commonly cultivated in these countries. All botanical minutiae of exotics are omitted, and thus much space is gained for the introduction of more useful matter. Since an exact acquaintance with the physical and chemical properties of the drugs in daily use is, in

the author's opinion, of essential service to every one who desires to prescribe with confidence and precision, the characters and tests of the various articles are fully specified, and the modes of detecting adulterations are described. To each metal a short general introduction on its chemical relations and therapeutic uses is prefixed, and all the preparations are described in alphabetical order as compounds of the metal. Although this involves some departure from the B. P. arrangement in a few cases, any risk of confusion is obviated by the use of cross references. Chemical equations in the modern notation are freely introduced, for the symbolic language of chemistry is the most exact and concise method of explanation, while to those who have not an elementary knowledge of chemistry, a diffuse verbose exposition of the symbols would convey but little information.

A conspicuous, and, it is hoped, a useful feature of the work is the frequent introduction of tabular arrangements and synoptical lists. Under each of the principal metals a pedigree or genealogical table of its preparations is given which exhibits their mutual relations at a glance. In these tables the parent substances from which other preparations are directly obtained are printed in heavy Egyptian type; while the compounds which yield no lineal derivatives are printed in small type, e. g. in the Antimonial Table, p. 114,—Antimonium nigrum is the

source of the chloride; from this is prepared the oxide, and from this the tartrate.

The physiological action and therapeutic uses of each article are, as a rule, necessarily limited to a general statement of their principal bearings, but important drugs, such as chloroform, cinchona, belladonna, and opium, are treated at greater length, and the practical points connected with their special uses and modes of administration are more particularly detailed.

The recently published Additions to the B. P. are incorporated into the text in their alphabetical order, and brief notices are furnished of some of the non-official drugs which are at present most in demand, or which promise to become permanent additions to our stock of remedies. The titles of drugs which are not in the B. P. are distinguished by italic capitals, as also the headings of the general introductions to the groups, e. g. *ACIDS*, *ALKALOIDS*, *EXTRACTA*, &c.

Care has been taken to ensure accuracy in the statement of facts, and in a work which necessarily owes much to the labours and writings of others it would be impossible to acknowledge all the sources to which the writer is indebted for information. But, in addition to the many excellent manuals on Chemistry and Materia Medica which have been consulted, the author desires to express his obligations to a work which is not so well known in this

country as it deserves, and which, as an accurate and richly stored treasury of information, is invaluable to all who are engaged in the study of *Materia Medica* or the physiological action of drugs—viz.: *Die Pflanzenstoffe in chemischer, physiologischer, pharmakologischer, and toxi-kologischer Hinsicht.* von Dr. A. Husemann und Dr. T. Husemann, Berlin, 1871.

*January, 1875.*

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## COMMENTARY

### CORRIGENDA.

Page	4,	line	9 from bottom,	<i>for acids read</i>	<i>ox-acids.</i>
„	23,	„	8 „ top,	<i>insert = before</i>	94.
„	39,	„	5 „ „	<i>for</i>	ACDIUM <i>read</i> ACIDUM.
„	47,	„	4 „ „	„	NH <sub>4</sub> HPO <sub>4</sub> „ (NH <sub>4</sub> ) <sub>2</sub> HPO <sub>4</sub> .
„	54,	„	11 „ bottom,	„	mpurity „ impurity.
„	159,	„	12 „ top,	„	Bi <sub>2</sub> O <sub>2</sub> „ Bi <sub>2</sub> O <sub>2</sub> .
„	163,	„	17 „ bottom,	„	B <sub>2</sub> O „ B <sub>2</sub> O <sub>3</sub> .
„	172,	last line,	<i>insert of before</i>	<i>the.</i>	
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„	224,	„	II „ „	<i>insert a before</i>	time.
„	240,	numbering of page,	<i>for</i> 024	<i>read</i>	240.
„	271,	line	9 from top,	„	DECOCTIONS „ DECOCTA.
„	289,	numbering of page,	„	28	„ 289.
„	309,	line	2 from bottom	„	3 „ 3'6.
„	314,	in Table,	„	Fe <sub>2</sub> 3SO	„ Fe <sub>2</sub> 3SO <sub>4</sub> .
„	370,	line	4 from bottom	„	HgCl „ HgCl <sub>2</sub> .
„	391,	„	3 „ top,	„	KI „ KI.
„	392	last word of last line	„	o	„ of.
„	445,	line	2 from top,	<i>insert = before</i>	87.
„	472,	<i>after</i>	number 8 of Volatile oils,	<i>insert</i>	Cinnamomi.
„	540,	line	3 from top,	<i>for</i>	pictorum <i>read</i> pictonum.
„	576,	last line,	<i>after</i>	with <i>insert</i>	all.
„	596,	line	7 from top,	<i>for</i>	CmH <sup>2</sup> nOn <i>read</i> CmH <sub>2</sub> nOn.
„	630,	„	8 „ „ „	„	N <sub>2</sub> HaAsO <sub>4</sub> „ Na <sub>2</sub> HaAsO <sub>4</sub> .

\* 'Ακάζω, to sharpen to a point; the branches being furnished with long thorns.

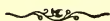
country as it deserves, and which, as an accurate and richly stored treasury of information, is invaluable to all who are engaged in the study of *Materia Medica* or the physiological action of drugs—viz.: *Die Pflanzenstoffe in chemischer, physiologischer, pharmakologischer, and toxi-kologischer Hinsicht.* von Dr. A. Husemann und Dr. T.



# COMMENTARY

ON THE

## BRITISH PHARMACOPŒIA.



### ACACIÆ GUMMI.

*Origin.*—Gum Acacia,\* or Gum Arabic, as it is more usually called, is a concrete spontaneous exudation from various species of Acacia, N. O. Leguminosæ, among others probably the *A. vera*, and *A. Arabica*, which grow abundantly in Africa, and also in Asia.

*Characters and Tests.*—The purer kinds are free from colour, and break with a vitreous fracture; the powder is greyish-white. The variety termed Senegal gum is in larger pieces—sometimes as large as an ostrich egg, generally of a transparent reddish, or brownish-red colour; it breaks with a conchoidal fracture, and is less soluble in water than gum Arabic. Exposure to sunshine partially bleaches the coloured varieties.

The white precipitate with subacetate of lead consists of gummate of lead ( $\text{Pb}_2\text{O}, 3\text{C}_6\text{H}_{10}\text{O}_5$ ), and is characteristic of true

\* 'Ακάζω, to sharpen to a point; the branches being furnished with long thorns.

gums, and serves also to distinguish the acetate from the *sub*-acetate of lead, as the former will not precipitate with pure mucilage. The term *gum* is sometimes erroneously applied to certain balsams and resins; e. g. benzoin and mastic.

From the researches of M. Frémy, it appeared that gum is essentially a combination of gummie or arabic acid (i. e. arabin) with lime, and a solution of the ash gives a white precipitate of oxalate of lime when treated with oxalate of ammonia.

Pure arabin can be separated by dialysis. Allied to arabin are the isomeric bodies cerasin (metagummie acid); bassorin, which occurs in tragacanth; and vegetable mucus. But gum Arabic is to be regarded not as an immediate vegetable principle, but rather as a mixture of the gummates of potassium, calcium, and magnesium.

The iodine test will readily detect the fraudulent addition of flour or starch, and it is necessary to allow the hot solution to cool before applying the test, as the blue colour of the iodide of starch is permanently discharged at a boiling temperature, but if iodine be added to a moderately warm solution of starch, the blue colour will be developed when the solution cools.

*In Pharmacy*—Gum is employed for the suspension of insoluble powders, e. g. *Mistura Cretæ*; of resin, e. g. *Mistura Guaiaci*; it is also an adjunct in *Pulvis Amygdalæ Compositus*, and *Pulvis Tragacanthæ Compositus*, and enters into the composition of all the Lozenges to give them the tenacity necessary to form them into tablets. Powdered gum or thick mucilage is also employed to make emulsions with balsams and oily substances.

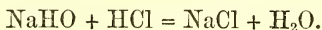
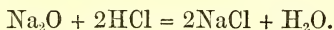
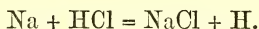
Gum is incompatible with alcohol or rectified spirit, which precipitate it from its aqueous solution, and *Tinctura Ferri Perchloridi* forms a jelly with mucilage, but not with dextrin.

*In Medicine*—Gum is chiefly employed as a demulcent, and when taken in large quantity it possesses some nutritive value, but its action is almost entirely local.

*ACIDS.*

The most familiar properties of acids, and indeed those by which they are commonly recognised, are that they have a sour taste, neutralise alkalies, and possess the power of changing the blue colour of litmus and other vegetable blues to red.

But though these characters apply to all *soluble* acids, they are not sufficiently comprehensive for the purpose of definition, and accordingly we will adopt the strict chemical definition of an acid, viz.:—*A compound of hydrogen in which the hydrogen can be wholly or partially replaced by an equivalent amount of a metal.* The hydrogen so replaceable is termed *basic* hydrogen, and the product which results from the substitution of a metal for the hydrogen of an acid is termed a *salt*, i. e. a “salt” is the metallic derivative of an acid. For example,



From these equations we learn that the metal may be presented to the acid either in the free state, as anhydrous oxide, or as a hydrate.

Acids which contain only one atom of replaceable or basic hydrogen are termed monobasic, e. g. HCl. Those which contain two or three atoms of replaceable hydrogen are termed respectively dibasic and tribasic, e. g.  $\text{H}_2\text{SO}_4$  and  $\text{H}_3\text{PO}_4$ .

We see, also, from the formulæ given that the number of atoms of hydrogen which stand at the commencement of the formula indicate at once the basicity of the acid, and hence we can readily group the acids on this principle. It is worth observing that all the chlorine and nitrogen-acids are monobasic; the sulphur acids dibasic; and the phosphorus and arsenicum-acids usually tribasic.



Acids may also be sub-divided according to their usual source, and thus we get the series of organic and inorganic acids, which are about equal in number in the Pharmacopœia.

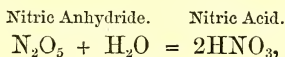
But a more important point to attend to is their chemical composition, and a glance at their formulæ will show that some of them contain hydrogen in union with but *one* other element or radicle (and that not oxygen), i. e. they are binary compounds, and may be termed the non-oxygenated acids. All the non-oxygenated acids are monobasic, except sulphuretted hydrogen ( $\text{H}_2\text{S}$ ), which is dibasic; one of them contains nitrogen (united with carbon to form the radicle cyanogen, which acts like a monad element), viz., Acidum Hydrocyanicum. The larger number of the acids, however, include hydrogen, oxygen, and some third element, i. e. they are ternary compounds, and they may be called the oxygenated acids, or briefly, oxacids.

The English names of acids always end in either *ous* or *ic*; all the non-oxygenated acids terminate in *ic*, e. g. hydrochloric acid; and among the oxygenated acids the rule is, that if there be only a single acid compound, it ends in *ic*, e. g. tartaric acid; while if there are two acid compounds of the same elements, the affix *ic* is given to the more oxygenised, and that of *ous* to the less oxygenised, e. g. sulphuric and sulphurous. The names of their derivative salts terminate in *ide*, *ate*, or *ite*; *ide* is a binary appellation corresponding to the non-oxygenated acids, e. g. hydrochloric acid forms *chlorides*; *ate* and *ite* are ternary appellations corresponding respectively to <sup>ox-</sup>acids in *ic* and *ous*, thus nitric acid yields *nitrates*; sulphurous acid yields *sulphites*.

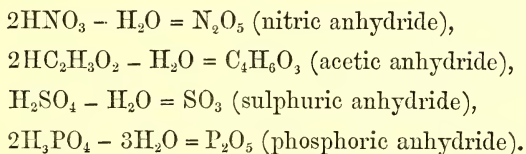
Looking again at the formulæ and definitions of the oxacids in the Pharmacopœia, we observe that the term “anhydrous acid” is frequently made use of, and that in some cases, e. g. Ac. Aceticum and Ac. Nitricum, the percentage amount is given in terms both of the “acid” and also of the “anhydrous acid.”

An “anhydrous acid,” or anhydride, as it is more correctly

named, is an oxygenated compound which is capable of combining with water so as to produce a true acid, e. g.



and it is the residue derived from a true acid by the elimination of water, e. g.



The anhydride of a dibasic acid, e. g. oxalic,  $\text{H}_2\text{C}_2\text{O}_4$  is obtained by directly subtracting one molecule of water,  $\text{H}_2\text{O}$ , from one molecule of the acid; therefore, the anhydride of a monobasic acid is got by subtracting one molecule of water from two molecules of the acid, i. e.  $\frac{1}{2}\text{H}_2\text{O}$  from the acid; and, similarly, the ultimate anhydride of a tribasic acid by subtracting three molecules of water from two molecules of the acid, i. e.  $1\frac{1}{2}\text{H}_2\text{O}$  from the acid.

Some anhydrides, e. g. oxalic, are so unstable that they have not been as yet obtained; while, on the other hand, some of the acids, e. g. sulphurous, are so readily separated into their respective anhydrides and water, that they cannot be isolated from their solutions, and only their anhydrides are known in the free state.

Different principles are followed in the preparation of the various acids; for example, some are obtained by simple sublimation or solution from their natural compounds, i. e. are *educts* (Ac. Arseniosum, Ac. Benzoicum, Ac. Tannicum); some by a process of oxidation, e. g. Acetum; Ac. Gallicum; Ac. Phosphoricum dil.; Ac. Sulphuricum; while others are derived by the converse process of deoxidation, e. g. Ac. Sulphurosum. Some

by destructive distillation, e. g. Ac. Aceticum ; Ac. Carbolicum ; while Tartaric and Citric acids are first precipitated as insoluble salts, and then set free by a stronger acid ; and lastly, most of the volatile acids (e. g. Ac. Aceticum glaciale ; Ac. Hydrochloricum ; Ac. Hydrocyanicum dil. ; and Ac. Nitricum), are, in accordance with Berthollet's law, procured from one of their respective salts by distilling it with the more fixed sulphuric acid : thus, any chloride, when heated with sulphuric acid, will furnish hydrochloric acid ; any nitrate similarly treated, nitric acid ; and so on. The mode of estimating the amount of acid present in a solution is explained under Volumetric Analysis, App. III.

## TABLE OF ACIDS IN THE BRITISH PHARMACOPŒIA.

### CLASS I.—NON-OXYGENATED.

#### *Monobasic.*

1. Acidum Hydrochloricum,	HCl = 31·80%.
2.     "                 "             dilutum	do. = 10·58.
3.     "     Hydrocyanicum     dilutum	HCN = 2·00.

### CLASS II.—OXYGENATED.

#### DIV. I.—*Monobasic.*

4. Acetum	$\text{HC}_2\text{H}_3\text{O}_2$ = 5·40%.
5. Acidum Aceticum	do. = 33·00.
"         "         dilutum	do. = 4·28.
"         "         glaciale	do. = 99·00.
6.     "     Benzoicum	$\text{HC}_7\text{H}_5\text{O}_2$ .
7.     "     Carbolicum	$\text{HC}_6\text{H}_5\text{O}$ .
8.     "     Nitricum	$\text{HNO}_3$ = 70·00.
"         "         dilutum	do. = 17·44.
9.     "     Nitrohydrochloricum dilutum.	

Div. II.—*Dibasic.*

10.	Acidum Sulphuricum	$\text{H}_2\text{SO}_4 = 96.80\%$ .
„	„ aromaticum	do. = 13.36.
„	„ dilutum	do. = 13.64.
11.	„ Sulphurosum	$\text{H}_2\text{SO}_3 = 11.80$ . $\text{SO}_2 = 9.2$ .
12.	Acidum Tartaricum	$\text{H}_2\text{C}_4\text{H}_4\text{O}_6$ .

Div. III.—*Tribasic.*

13.	Acidum Arseniosum	$\text{H}_3\text{AsO}_3^*$ . Anhydride = $\text{As}_2\text{O}_3$ .
14.	„ Citricum	$\text{H}_3\text{C}_6\text{H}_5\text{O}_7 \cdot \text{H}_2\text{O}$ .
15.	„ Gallicum	$\text{H}_3\text{C}_7\text{H}_3\text{O}_5 \cdot \text{H}_2\text{O}^\dagger$
16.	„ Phosphoricum dilutum	$\text{H}_3\text{PO}_4 = 12.8\%$ .
17.	„ Tannicum	$\text{C}_{27}\text{H}_{22}\text{O}_{17} \cdot \frac{1}{2}$

## ACIDS IN THE APPENDIX.

18.	Boracic acid	$\text{H}_3\text{BO}_3$ (or $\text{HBO}_2 \cdot \text{H}_2\text{O}$ ).
19.	Oxalic „	$\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ .
20.	Sulphuretted hydrogen	$\text{H}_2\text{S}$ (hydrosulphuric acid).

## ACETUM.§

Vinegar|| is an impure dilute acetic acid, derived from alcohol, the product of the fermentation of malt or unmalted grain. In the British Pharmacopœia of 1864, vinegar was described as being prepared from French wines; but in Britain it is made from the fermented infusion of malt, which is exposed very freely to the air, so as to allow of a sufficient access of oxygen, and consequent slow oxidation of the alcohol. Other saccharine and vinous liquids, such as cider, also readily undergo acetifica-

\* This acid has not been isolated; only the anhydride is known.

† According to Naquet, gallic acid is monobasic.

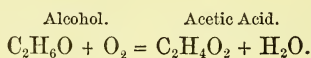
‡ The constitution of tannic acid is not yet precisely ascertained, but from its affinity to gallic acid it is placed in the same group.

§ From *aceo*, to be sour.

|| From the French *vin aigre*, sour wine.

tion ; in fact, any liquid which is susceptible of vinous fermentation can be transformed into vinegar. British vinegar is not quite so strong as French vinegar.

The essential changes which occur during the progress of the acetous fermentation are these :—The sugar of the malt or grain first passes into alcohol ; and the alcohol, by further oxidation under the influence of a fungus which is found in the solution, is transformed into acetic acid. The relation which acetic acid bears to alcohol is a simple one, as appears from the following equation :—



And it will be observed that the acid is derived from the alcohol by the substitution of O for  $H_2$ . This equation, it should be remembered, is a typical one, for every alcohol by oxidation yields its corresponding acid, and we shall see in the case of valerianate of soda how valerianic acid is similarly derived from amylic alcohol.

*Characters and Tests.*—The odour of vinegar or of acetic acid in any form is characteristic, and its colour, although noticed as being brown, is subject to considerable variation. The peculiar aroma of vinegar is probably due to the presence of a minute quantity of acetic ether. The percentage of acetic acid is also liable to fluctuation, but the volumetric test indicates that one fluid ounce should contain 4·6% of *anhydrous* acetic acid, = 5·4% of acetic acid ( $HC_2H_3O_2$ ) ; for, since 1000 grain measures of the soda solution contain one molecule of soda,  $NaHO$ , they will neutralise 60 grains, i. e. one molecule of acetic acid,  $HC_2H_3O_2$ , because acetic acid is monobasic, and  $1000 : 402 :: 60 : x = 24·12$  grains of acetic acid = 5·4%.

Vinegar is liable to become mouldy when long kept, particularly if it be exposed to the air, and usually contains traces of sulphuric acid, added for the purpose of preserving it.  $\frac{1}{1000}$  part by weight of sulphuric acid is allowed by law to be added, but if



the vinegar be properly made it does not require this addition; the chloride of barium will detect the presence of that acid, white sulphate of barium being thrown down. The ten minims of the solution of  $\text{BaCl}_2$  contain 0.918 grains of  $\text{BaCl}_2$ , which would be competent to precipitate exactly 0.036 grains of sulphuric acid, a quantity less than that allowed by law. Should the vinegar contain any copper or lead derived from vessels used in its manufacture, the sulphuretted hydrogen will discolour it, the sulphides of lead and copper being black and insoluble. The three monobasic organic acids, viz., acetic, benzoic, and carbolic each give a characteristic reaction with ferric chloride. Thus, acetic acid gives a blood-red solution (e. g. Tr. Ferri Peracet.) decomposed on boiling, depositing a reddish precipitate and evolving the odour of acetic acid. Benzoic acid gives a bulky reddish-brown precipitate, and carbolic acid, in aqueous solution, gives with Liq. Ferri Perchlor. (*not* the Tinct.) a violet-blue colour.

*In Pharmacy.*—In the preparation of Emplastrum Cerati Saponis, the vinegar serves to dissolve the oxide of lead before the other ingredients are added.

*In Medicine.*—Its uses are those of a refrigerant and diuretic, but it is not much employed internally. Though used with benefit in small quantities as a condiment, in large quantities it interferes seriously with the digestive functions, and its popular use among young people as a means of reducing corpulency cannot be too strongly condemned. When given freely in scarlatina or other febrile diseases, it frequently acts as a diaphoretic. In poisoning by the caustic alkalies or by lime, it is the most suitable antidote, and acts by converting these bases into innocuous acetates.

Locally, it is commonly used as a lotion in bruises and sprains, and for sponging the body in febrile affections.

It is well adapted for neutralising the caustic action of small particles of lime which may have entered into the eye. In such a case, it should be first diluted with water.

## ACETUM CANTHARIDIS.

A useful preparation, adopted from the London Pharmacopœia, and suitable for extemporaneous vesication, but too strong for internal use. Cantharidin, the crystalline vesicating principle of the insect, is soluble in strong acetic acid with the aid of heat.

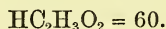
This preparation contains eight times as much cantharides as the Tincture, and, if applied too long, is apt to produce ulceration.

## ACETUM SCILLÆ.

This preparation, which found a place in the former Dublin, London, and Edinburgh Pharmacopœias, was omitted in the first edition of the British Pharmacopœia, but is now restored. Maceration is preferred to percolation in preparing it, because squill swells up, and, with the menstruum, forms an adhesive mass which is not adapted for percolation.

Vinegar of squill is apt to get mouldy by keeping; and for that reason, as well as on account of the more agreeable taste, the syrup of squill is to be preferred.

## ACIDUM ACETICUM.



Acetic acid occurs in the Pharmacopœia in three grades of strength, the relative proportions of which are shown in the following table :—

	Acetic Anhydride.	Acetic Acid.
Ac. Aceticum . . . . .	28·00% . . . . .	33·00%
Ac. Acet. dil. . . . .	3·63 . . . . .	4·28
Ac. Acet. glac. . . . .	84·00 . . . . .	99·00

The glacial acid is exactly three times as strong as acetic acid; which, again, is eight times as strong as the diluted acetic acid.

*Preparation.*—When any wood, except pine, is submitted to

destructive distillation, it yields, besides many other volatile products, an acid liquor contaminated with creasote and other empyreumatic and tarry substances.

By the purification of this brown acid liquor, or crude pyroligneous acid, and neutralisation with lime, an acetate is produced, which, by distillation with sulphuric or hydrochloric acid, yields the acetic acid free.

*Characters and Tests.*—The pungent odour, as was remarked before, of vinegar is characteristic; but if it should partake of a tarry character, the presence of empyreumatic oil would be betrayed. If pure, 182 grains by weight, containing 60 grains real acetic acid (i. e. one molecule), will exactly neutralise 1000 grain measures of the soda solution (i. e. one molecule NaHO), because acetic acid is monobasic.

Any fixed residue left after evaporation would show impurity; and sulphuretted hydrogen, chloride of barium, and nitrate of silver, are the tests respectively for lead and copper, sulphuric acid, and hydrochloric acid.

It is liable to contain sulphurous acid derived from the sulphuric acid used in its preparation, and the subacetate of lead test is intended to detect this impurity. The test is thus explained. The hydrogen gas, developed by the zinc and hydrochloric acid ( $\text{Zn} + 2\text{HCl} = \text{ZnCl}_2 + \text{H}_2$ ), if it meets with sulphurous acid, forms sulphuretted hydrogen ( $\text{SO}_2 + 3\text{H}_2 = 2\text{H}_2\text{O} + \text{H}_2\text{S}$ ), and the sulphuretted hydrogen will then discolour the lead paper, owing to the formation of black sulphide of lead.

*In Pharmacy.*—It is employed in the preparation of the Galenical formulæ, Acetum Cantharidis; Ext. Coleh. Acet.; Linim. Tereb. Acet.; Liq. Epispasticus, and Oxy-mel; and, in the Injectio Morph. Hypoderm. it is used to redissolve the precipitated morphia. All acetates are soluble in water.

It is commonly added to prescriptions which include acetate of lead, with a view of preventing the conversion of that salt into carbonate by the  $\text{CO}_2$  of the atmosphere.

*In Medicine.*—When undiluted, the acid is a stimulant, and its vapour may be employed for that purpose in cases of fainting, headache, &c. The crude pyroligneous acid is possessed of considerable antiseptic powers, and has been applied with advantage to the preservation of animal food, and in surgery it has been beneficially applied to gangrenous and unhealthy sores.

### ACIDUM ACETICUM DILUTUM.

This preparation may in all cases be substituted with advantage for vinegar, as it is definite in strength, though it is about one-fourth weaker. Moreover, when alkalies are added to vinegar, they darken it, or may even occasion a precipitate on account of the organic matter present. This objection does not hold with the diluted acetic acid. When administered internally, its effects are precisely the same as those of vinegar, and it has been employed with advantage in scarlatina.

*In Pharmacy.*—It is used for preparing vinegar of squill, the acrimony of which it is considered to mitigate; and in the *Liq. Morph. Acet.* it aids in the solution of the alkaloid, two minims being added for each grain of the salt.

### ACIDUM ACETICUM GLACIALE.

Since acetic acid is volatile, it may be liberated from any acetate by distilling the salt with a more fixed acid. In the last edition of the *Pharmacopœia*, it was prepared by heating acetate of soda with sulphuric acid, but its preparation is now left in the hands of the manufacturer.

*Characters and Tests.*—This acid derives the term “glacial” from the circumstances of its ready congelation, and its similarity, when congealed, to ice. The sp. gr. of acetic acid at different strengths is remarkable; up to a certain point its density increases with its strength, until it attains a maximum of 1.073 corresponding to 80% of  $\text{HC}_2\text{H}_3\text{O}_2$  and to the hydrate  $\text{HC}_2\text{H}_3\text{O}_2 + \text{H}_2\text{O}$ . But with a further increase in the strength, the density

falls, till at 99% of  $\text{HC}_2\text{H}_3\text{O}_2$  the sp. gr. stands at 1.065. The sp. gr., therefore, of the glacial acid is raised by the addition of a certain amount of water, till it reaches 1.073, when any further dilution permanently lowers it. The volumetric test indicates that 60 grains contain virtually one molecule of the acid, which, if perfectly pure and rigidly determined, would require 1000 grain measures of the soda solution (= 1 molecule  $\text{NaHO}$ ). The last test (i. e. for sulphurous acid) has been already explained under the head of *Ac. Aceticum*.

*In Pharmacy.*—The glacial acid is a powerful solvent of many organic substances, such as resins, camphor, gum, sugar, and volatile oils, and the old-fashioned perfume and remedy, *aromatic vinegar* (Thieves' vinegar\*), is a solution of camphor and various essential oils in concentrated acetic acid.

Being also a good solvent of cantharidin, it enters into the preparation of *Acetum Cantharidis*.

*In Medicine.*—It dissolves all the protein bodies (fibrin, albumen, &c.), except casein. Hence it is sometimes employed as a caustic for the destruction of warts and corns, as a rapid vesicant, and as a powerful cutaneous stimulant in some chronic skin affections.

## ACIDUM ARSENIOSUM.†

ANHYDRIDE,  $\text{As}_2\text{O}_3 = 198$ .

*Origin.*—This substance, the well-known “white arsenic,” is prepared on the large scale in Bohemia, Saxony, and Corn-

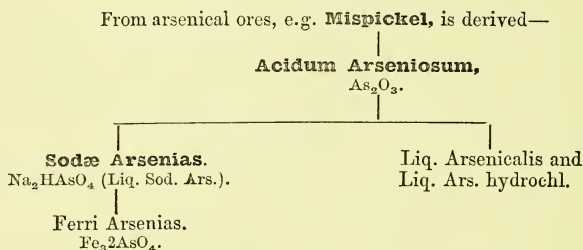
\* The repute of this preparation as a prophylactic in contagious fevers is said to have arisen from the confession of four thieves, who, during the plague of Marseilles, plundered the dead bodies with perfect security, and, upon being arrested, stated on condition of their lives being spared, that the use of Aromatic Vinegar had preserved them from the influence of contagion (Paris).

† Arsenic—*Ἀρσην*, or *Ἀρρῆν*, vigorous; or *Ἀρρηνικός*, masculine; from its power as a poison.

wall, by the roasting of arsenical ores, and in especial, arsenical cobalt, and mispickel, an arsenio-sulphide of iron,  $\text{FeSAs}$ . The arsenicum of the ore is oxidised into arsenious oxide ( $\text{As}_2\text{O}_3$ ), which sublimes. This is collected, and finally purified by re-sublimation.

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### GENEALOGICAL TABLE OF THE ARSENICAL COMPOUNDS.



*Characters and Tests.*—When in masses, arsenious oxide is a dense, smooth, milk-white substance, remarkably like fragments of white porcelain. The stratified appearance is due to its capacity of existing in both a transparent and an opaque state; and though when recently sublimed it is vitreous, when kept for some time it becomes opaque; and as the change proceeds from the surface to the centre, a large mass, when broken, is often found to be translucent internally.

The sp. gr. of the opaque form is 3.699; of the vitreous, 3.738, and the latter is three times more soluble in water than the former. Since the oxide when powdered is more liable to contain impurities, or to be mistaken for other white powders, it is advisable to keep it in masses.

The lustrous *octahedral* crystals obtained by slow sublimation are highly characteristic, and furnish a useful test for the presence of arsenic. But arsenious oxide sometimes crystallises in prisms with a rhombic base, and, accordingly, is a dimor-



phous body. It has no taste, except in hot, strong solution, when it is said to resemble that of sulphate of zinc. Dr. Christison and others state that it has a faint, sweetish taste.

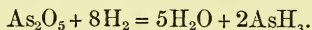
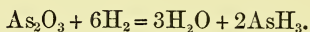
Its solubility in cold water is about 1 in 100; in boiling water, 1 in 20 (Squire); but the difference in solubility of its two varieties is to be remembered, and also that prolonged boiling transforms the opaque into vitreous (i. e. more soluble) anhydride. The varying quantities of the vitreous and opaque forms in the samples experimented on will partly explain the discrepancies as to its solubility which occur in the statements of different authors.

The presence of organic matters very much impairs the solvent power of water for this substance, but acids and alkalies render it more soluble, e. g. Liq. Arsen. Hydrochlor. and Liq. Arsenicalis, in neither of which is it probable that the  $\text{As}_2\text{O}_3$  is in chemical combination with the solvent. When it does combine with bases to form arsenites, they are all insoluble, except the alkaline arsenites.

The canary-yellow precipitate of arsenite of silver ( $\text{Ag}_3\text{AsO}_3$ ) which arsenious acid gives with ammonio-nitrate of silver (Hume's test), is one of the best colour tests for it, but we should not forget that phosphoric acid behaves similarly. Arsenious acid is, however, further distinguished by giving a yellow precipitate of orpiment ( $\text{As}_2\text{S}_3$ ) with sulphuretted hydrogen in an *acid* solution, and an apple-green precipitate of arsenite of copper ( $\text{CuHAsO}_3$ , Scheele's green) with ammonio-sulphate of copper, while Marsh's and Reinsch's tests are decisive of the presence of even very minute quantities of arsenic.

Marsh's test consists essentially in introducing the arsenical solution to be tested into an apparatus in which *pure* hydrogen is generated. The hydrogen is best developed by means of zinc and hot solution of potash or soda ( $\text{Zn} + 2\text{KHO} = \text{ZnK}_2\text{O}_2 + \text{H}_2$ ), because antimony will not combine with this form of hydrogen, although arsenicum will (Fleitmann). A source of

fallacy is thus avoided. The As at once forms arseniuretted hydrogen gas with some of the nascent hydrogen, thus :—



When the jet of escaping gas is ignited, and a cold, white body, such as the lid of a porcelain capsule, held in the livid blue flame, a brown spot of As is deposited, because  $\text{AsH}_3$  is decomposed by the heat of combustion, and the hydrogen burns off into water.

Reinsch's test consists in boiling a strip of *pure* clean copper in the solution of arsenic acidified with  $\text{HCl}$ ; the arsenicum will be deposited on the copper strip, and, when dried, can easily be subjected to further experiment. White arsenic has no smell, even in the state of vapour, and the garlic-like odour exhaled when it is sprinkled on a red-hot coal is due to the reduction of the arsenicum by the carbon ( $\text{As}_2\text{O}_3 + \text{C}_3 = 3\text{CO} + \text{As}_2$ ), and the subsequent volatilisation of the arsenicum which then emits an alliaceous odour at the instant of its re-oxidation.

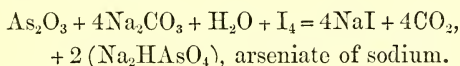
This "reduction test," when performed with care in a narrow tube, is analytically of considerable interest, since the liberated arsenicum forms a steel-like coat in the cool part of the tube. To apply this test, a few grains of the arsenical powder are placed at the bottom of the tube, and covered with a layer of black flux (a mixture of carbon and carbonate of potash, obtained by heating cream of tartar in close vessels). The flame of a lamp is directed first on the charcoal, and then on the arsenical powder, which is deoxidised by the charcoal, and the sublimed arsenicum condenses as a lustrous grey ring round the more distant part of the tube. This mirror-like ring, when again heated with access of air, will reproduce octahedral crystals of arsenious oxide. Thus for arsenic in the *solid* state, we have the three tests of sublimation, reduction, and re-oxidation; while in *solution* we recognise it (1) by the



action of  $\text{H}_2\text{S}$ ; (2) by Hume's test; (3) by ammonio-sulphate of copper; (4) by Marsh's test; and (5) by Reinsch's test. The powder is sometimes adulterated with chalk or sulphate of lime, but these will be left behind if the oxide be heated to  $400^\circ \text{F.}$ , its point of sublimation.

The quantitative estimation of arsenious acid is effected by ascertaining how many grain-measures of standard solution of iodine are decolorised by a known weight of the acid.

First, the oxide is dissolved in a hot solution of bicarbonate of sodium, and then the iodine solution is added so long as its colour is discharged, owing to colourless iodide of sodium being formed. The bicarbonate is converted into normal carbonate of sodium by boiling. The changes that take place are expressed in the following reaction:—



One molecule of white arsenic,  $\text{As}_2\text{O}_3$  (198 grains), will decolorise four atoms of iodine (i. e. 508 grains,  $= 127 \times 4$ ). 1000 grain measures of iodine solution (which contain  $\frac{1}{10}$  of one atom of iodine) are equal to 4.95 grains of  $\text{As}_2\text{O}_3$  (i. e.  $\frac{1}{40}$  of a molecule,  $\frac{198}{40}$ ), therefore, 4 grains of arsenious oxide, if pure, should require 808 measures of the iodine solution;  $4.95 : 4 :: 1000 : 808$ .

*In Pharmacy.*—Used in the preparation of Sodæ Arsenias.

*In Medicine.*—Arsenic has been exhibited in a great variety of diseases, but most of its applications may be referred to either as a local irritant and caustic externally, or as a tonic and antiperiodic internally.

It has long been a favourite in the treatment of external cancer, lupus, and malignant ulcers; and numerous pastes, powders, and lotions have been proposed for this purpose. But such a mode of administering this remedy is open to the objection that it is an irritant poison, and that the absorption of

it in any quantity is attended with extreme danger. Many cases of death have resulted from its improper use in the hands of ignorant or careless practitioners. On account of its escharotic qualities, a large quantity, externally applied, is not so dangerous as the repeated application of smaller quantities, the slough that is formed in the first case impeding the absorption of the poison.

There can be little doubt that the ingestion of small quantities of arsenic for lengthened periods is not incompatible with perfect health; and Dr. Paris mentions it as a very extraordinary fact, that, previous to the establishment of the copper-smelting works in Cornwall, from which arsenical fumes are given off, the marshes in their vicinity were continually exciting intermittent fever, whereas, since that period, a case of ague had not occurred in the neighbourhood, although this circumstance could not be explained by any agricultural improvements which had taken place. The animals and vegetables in the vicinity were injuriously affected by the arsenical vapours, but the men employed in the works were "more healthy than we could, *à priori*, have supposed possible." It is said that cutaneous affections are rare in parts of Sweden, where arsenical limestone is present; and there is a river in Cumberland which contains a perceptible amount of arsenic, and which is used for all purposes by the inhabitants, who enjoy particularly good health. Dr. Maclagan and others have proved the truth of the accounts related of the arsenic eaters of Styria, which were so long scouted as travellers' tales.

Internally, arsenic is most valuable as an antiperiodic, and will succeed sometimes in curing intermittent fever where Peruvian bark or its alkaloids have failed. Hence, also, its use in periodical headache and neuralgia, in chorea, and, above all, in those constitutional skin affections which are marked by a tendency to *relapse*, e. g. chronic pemphigus, psoriasis, and some forms of eczema, and lichen. It appears to act especially as a

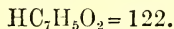
tonic to the nervous and cutaneous systems. The common indication given for its use in affections of the skin is in the *scaly* diseases; but its administration on the above view, first suggested, I believe, by Mr. Startin, opens up a wider field of action, and is more consistent with its admitted antiperiodic virtues.

Arsenic has also been administered with considerable success, in small doses, in cases of irritative dyspepsia, and in those cases of chronic dyspepsia attended with diarrhœa of ill-digested food, often seen in young children; and, in the distressing vomiting of drunkards, it is stated by Dr. Ringer to be of the highest value. One or two minims of the Liq. Arsenicalis are to be given shortly before each meal. A good deal of attention has lately been drawn to its employment in phthisis, and it is asserted to possess the power of arresting the disease in a remarkable degree; but further observations are needed before we can know what value is to be attached to it. The best signs of arsenic decidedly affecting the system are either gastric irritation and purging, or, perhaps, better still, redness of the conjunctiva and lower eyelids, attended with itching, and possibly, some œdema. Salivation and falling off of the hair and nails are commonly reckoned among its specific effects; and it is also believed by some, when administered for weeks or months, to cause an eruption of dull brown spots, apparently pigmentary in their nature, and chiefly affecting parts covered by the clothing. When an overdose of arsenic has been swallowed, accidentally or otherwise, after the stomach has been emptied by the stomach-pump, and by emetics of sulphate of copper or sulphate of zinc, and demulcent drinks, such as milk, have been freely exhibited, recourse must be had to the proper antidotes. *Light* magnesia (Bussy) has been employed with success as an antidote; but the one which is in greatest repute is the hydrated peroxide of iron, originally suggested by Bunsen and Berthold. Both these antidotes act by converting the arsenic into an insoluble salt. It is essential that the peroxide of iron

should be recently prepared, *moist*, and given very freely, as at least 10 or 12 parts of the antidote are needed to counteract one part of the poison. The Ferri Peroxidum Humidum of the Pharmacopœia will fulfil these indications. The irritant effects of aniline colours on the skin are due, in some cases, to contamination with arsenic. Arsenious acid seems to have formed the basis of the once celebrated poison, the *aqua Tofana*.

The average dose of white arsenic is from the  $\frac{1}{24}$  -  $\frac{1}{10}$  grain, and the most convenient form of administering it is Fowler's Solution (Liq. Arsenicalis), freely diluted, and taken after meals, so that it may be mingled with the food. In all cases its effects should be carefully watched, and the occurrence of any unpleasant symptoms, such as those before mentioned, will warn us to reduce the dose or suspend the use of the remedy for a few days, but with care its use may be continued with safety for a great length of time. Two solutions of arsenious oxide are in the Pharmacopœia—one alkaline, the Liq. Arsenicalis (Fowler's Solution); the other, acid, the Liq. Arsen. hydrochl. (De Valangin's Solution). The latter will sometimes be tolerated by the stomach, when the former is rejected. Three to five minims of either "liquor" are an average dose for an adult, and 1 or  $1\frac{1}{2}$  minims for a young child, for arsenic is borne well at all ages. It is seldom necessary to push the dose beyond five minims, three times a day; and if there is any tendency to gastric disturbance, a few drops of laudanum may be added to each dose. A solution of iodide of arsenic and mercury was introduced by Mr. Donovan, of Dublin, in 1839, and has gained considerable testimony in its favour both in this country and abroad; but it is more usual to prescribe the simpler formulæ containing arsenic.

## ACIDUM BENZOICUM.



*Origin and Preparation.*—The source of this acid is the aromatic balsam, benzoin, which contains from 8 to 15% of the acid, and since the acid is easily volatilised, it is generally prepared by sublimation, and hence was formerly called “flowers of benjamin.” Besides benzoin, this acid occurs in many other resins and balsams, and in various natural orders. It was the first vegetable acid isolated as such.

In the last edition of the Pharmacopœia a process was given for its preparation. A quantity of benzoin is placed in an iron pot, surmounted by a paper cap or receiver, and when a gentle heat, just sufficient to melt the benzoin, is applied, the acid rises in vapour, and adheres to the sides of the paper receiver, from which it is removed, and, if not quite white, is resublimed. The acid is now largely obtained from hippuric acid, so abundant in the urine of herbivora. This acid is really glyco-benzoic acid, and can be readily resolved into glycoicin (sugar of gelatin) and benzoic acid— $\text{C}_9\text{H}_9\text{NO}_3 + \text{H}_2\text{O} = \text{C}_2\text{H}_5\text{NO}_2 + \text{C}_7\text{H}_6\text{O}_2$ . Many other methods for its artificial preparation are known to chemists, but are not as yet of commercial importance.

*Characters and Tests.*—The silky plumose crystals are characteristic of this acid; it is never pulverulent. Though quite colourless when pure, it is sometimes brownish, owing to the presence of oily matter, derived from the resin of the benzoin, and accordingly too high a temperature is avoided in its preparation. The agreeable aromatic odour is also due to the admixture of this volatile oil, for the pure acid is odourless. It requires for solution 200–300 times its weight of cold water, and 12 parts (Squire), twice its weight (Naquet) of boiling water. The addition of phosphate of sodium, or of borax, increases its solubility; 1 part of borax with 1 part of acid, being soluble in 100

parts of water. Soluble in 4 parts of rectified spirit, and also in the fixed oils. It unites with lime and the alkalies to form soluble benzoates, and from these, in consequence of the sparing solubility of benzoic acid, any more soluble acid, such as hydrochloric, will precipitate the benzoic acid, except from very dilute solutions, e. g.  $\text{NH}_4\overline{\text{Bz}} + \text{HCl} = \text{NH}_4\text{Cl} + \text{HBz}$  (benz. acid).  
<sub>benz. of ammon.</sub>  
 Neutral benzoates give a bulky reddish precipitate of ferric benzoate, with persalts of iron.

Its solution reddens litmus paper, but its acid powers are feeble. When heated it should sublime without any considerable residue, thus proving the absence of fixed impurities, such as lime or asbestos. Its vapours are acrid and suffocating.

*In Pharmacy.*—Benzoic acid, or its ally, cinnamic acid, is a distinctive constituent of the *true* balsams, viz.:—Balsam of Peru, of Tolu, benzoin, and storax. Benzoic is distinguished from cinnamic acid by *not* yielding hydride of benzoyl (oil of bitter almonds) when oxidised. It is one of the ingredients in paregoric elixir (Tinct. Camph. Co.), and in Scotch paregoric (Tinct. Opii Ammon.)

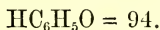
*In Medicine.*—Benzoic acid is considered to be a stimulating expectorant and diuretic, but is seldom used alone. It has been used with benefit in incontinence of urine, and in cases of phosphatic deposits in the urine, which it helps to keep in solution. While passing through the system it undergoes a remarkable change. Except in certain cases of jaundice, benzoic acid ingested in any form does not pass out as such in the urine, but is converted into a nitrogenous acid, hippuric, by combining with the elements of glycocin (sugar of gelatin).  
 $\text{HC}_7\text{H}_5\text{O}_2 + \text{C}_3\text{H}_5\text{NO}_2 = \text{HC}_9\text{H}_8\text{NO}_3 + \text{H}_2\text{O}$ . Some succinic acid is also formed.  
<sub>benz. acid.      glycocin.      hippuric acid.</sub>  
 If one of the homologues of benzoic acid be taken instead of it, the urine will contain a homologue of hippuric acid. Conversely, hippuric acid can be resolved into benzoic acid and glycocin by boiling with HCl, and of late years benzoic acid



is commercially prepared from the urine of the herbivora, which contains hippuric acid.\* The acid may be given in pill; 5 grains with 1 minim of glycerin. A lotion (20 or 40 grains to a pint) has been used to relieve the itching of chronic urticaria, and other skin affections.

## ACIDUM CARBOLICUM.†

(PHENIC ACID.)



*Origin and Preparation.*—Among the numerous acid, basic, and neutral constituents of coal-tar, some of which, and their derivatives, are of the highest value in the arts, the most important, from a medical point of view, is carbolic acid, so named by Runge, who discovered it nearly forty years ago. When bituminous coal is distilled in a close vessel, a large quantity of a dark viscous matter, known as *coal-tar*, comes over, and this, when subjected to fractional distillation,‡ yields as its most abundant acid product, the carbolic acid of commerce. It exists in that portion of the coal-tar which distils over between 300° and 400° F.

It is stated to be a constituent of castoreum, of the urine of the cow and of other animals, and even to occur in human urine.

*Characters and Tests.*—When pure, it occurs as a mass of

\* When horses have been worked hard their urine contains benzoic instead of hippuric acid (Naquet).

† *Carbo*, a coal.

‡ Fractional distillation is a process adapted to the rectification of a mixture of volatile liquids, whose boiling points differ considerably from one another. It consists in a series of graduated successive distillations, separating those portions of the mixture which distil at the same fixed temperature.

colourless needle-shaped crystals, which are prone to deliquescence, and to change their colour—first, to a rose pink (rosolic acid,  $C_{12}H_{12}O_3$ ), and then to a brown tint (brunonic acid). The fusing point is stated to be  $95^\circ$ , but, according to Crace Calvert, the purest phenic acid does not melt under  $106^\circ$ . The boiling point of the pure acid is  $370^\circ$ ; but it is sometimes accompanied by cresylic acid (cresol), a higher homologue ( $C_7H_5O$ ), which boils at  $397^\circ$ . The liquefied acid bears a strong resemblance in many ways to beech-wood creasote; but they are not to be confounded, for, besides that the odour of carbolic acid is much more tarry, they are chemically quite distinct. Yet it is frequently the case that the so-called creasote of the shops is nothing but impure carbolic acid. Its sp. gr. and boiling point are lower than those of wood creasote. (See table under *Creasotum*.)

A minute trace of moisture is sufficient to liquefy the crystals, and it is possible to obtain a hydrate of phenic acid, which crystallises in 6-sided prisms, by agitating 4 parts of carbolic acid with 1 of water at a low temperature.

The purest phenic acid is soluble in 20 parts of water (Calvert), and its solubility in water is much increased by the addition of from 5 to 10% of alcohol or of acetic acid. Alcohol, ether, glycerin, and strong acetic acid, take it up in all proportions. A drop of it let fall on paper causes a transient greasy stain, and it does not redden blue litmus paper. This latter character is at variance with the term *acid*, generally applied to it; and strictly speaking, it is not a true acid at all, nor does it form stable salts with alkaline bases. It is separated unchanged on heating any of its basic compounds. Chemically it belongs to and represents a series of bodies termed *Phenols*, which, though having the composition of alcohols and several properties of acids, yet differ essentially from both these classes of substances. The colour-test, with a slip of deal and HCl, is a fallacious one, and requires some time for its development. The property of coagulating albumen is common to it with



creasote, and accounts for the white stain that follows its application to the skin or mucous membranes. Its inactivity towards a ray of polarised light distinguishes it from wood-creasote, which is dextro-gyrate.

*In Pharmacy.*—Forms 1 part in 6 by weight of the Glyc. Acid. Carbol., and 1 grain in each of the new Suppos. Ac. Carbol.  $\bar{c}$ . Sapone.

*In Medicine.*—Few remedies have received more consideration, or been credited with so many virtues as carbolic acid, and without according to it all that its more eager advocates claim, we undoubtedly owe much to Mr. Calvert, who was the first to call attention to it, and to indicate its practical applications.

*Externally.*—When concentrated, it is a powerful stimulant, and even escharotic, and as its caustic action is superficial, it is especially adapted to the treatment of diphtheritic or malignant angina. It is possessed of undoubted deodorising and antiseptic powers, and accordingly it has proved highly valuable as a local application to foetid and unhealthy ulcers, anthrax, and caries or necrosis. A few drops of the liquid acid added to urine will ensure its keeping sweet for a length of time. In the superficial forms of lupus, it is an admirable caustic, and when diluted, is of great service as a stimulant to certain chronic skin eruptions, such as psoriasis and the advanced stages of eczema. It will often allay troublesome itching, and is one of the best applications for the relief of foetid perspirations from the feet and armpits.

Being inimical to animal and vegetable life it will easily destroy the itch insect, and is often useful in the vegetable parasitic eruptions, such as ringworm. Caution is requisite in applying the acid too freely externally, for several cases of poisoning, some of them fatal, have occurred unexpectedly from its incautious or accidental exhibition in too large quantities. Dark coloration of the urine has often been induced simulating hæmaturia, and at the same time alarming symptoms of prostration, nausea, &c., have been brought on. Professor Lister,

of Glasgow, believing that the chief cause of the suppuration of wounds is the contact of air containing certain living organisms or germs, has brought prominently forward a method of treating open wounds based on this doctrine. The cardinal points of the "antiseptic method" are, that air should be excluded from wounds or abscesses if possible, or, at least, that when air cannot be excluded, it should be disinfected by carbolic acid, and that all instruments, ligatures, &c., that are brought into contact with the part should also be similarly disinfected. Mr. Lister, moreover, insists on many other precautions, the details of which cannot be given here.

*Internally.*—In large doses, e. g. half an ounce, it is a violent irritant poison, and has been the cause of not a few deaths. The best remedies are olive oil, and castor oil, and saccharate of lime, but a true antidote remains yet to be discovered.

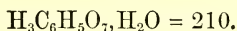
Like its congener, creasote, carbolic acid has been advantageously employed in the treatment of gastric affections, especially heartburn, and vomiting has been checked by it when creasote had failed. The acid would destroy any sarcinæ or other minute organisms that were present. As a powerful astringent, it has been successfully used in chronic diarrhœa, and its deodorising powers suggest its employment in cases of foetid breath or eructations, and as an inhalation in pulmonary diseases attended with fœtor.

*Administration.*—As a caustic it may be applied in the solid state, or when liquefied by heat, or as an ointment. For a lotion it is best dissolved in water in the proportion of 1 to 30 or 40 parts, and a little glycerin may be added with advantage, while the Glyc. Acidi Carbol. is an elegant preparation for the treatment of chronic skin eruptions, especially psoriasis and eczema. Carbolic acid soap, of which there are several strengths in commerce, is an efficient and convenient form in many cases. Internally 1 grain of the crystals is sufficient to begin with, dissolved in sweetened water, or, in emulsion with sugar and

yolk of egg, or in pill. Few can tolerate more than five or six grains. Instead of the free acid the carbolates of potassium and sodium have been used, and Dr. Sansom strongly advocates the sulphocarbates as being possessed of the specific properties of the acid while devoid of its disagreeable odour and irritant effects.

Mr. J. Wood finds sulphocarbonate of zinc the best injection for gonorrhœa.\*

### ACIDUM CITRICUM.

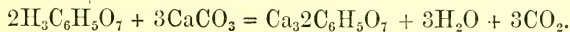


*Origin.*—Citric acid occurs in many plants and acidulous fruits, but especially in those belonging to the Aurantiaceæ, and it is commonly extracted from the juice of the lemon or the lime by Scheele's process, viz.: that which is adopted in the Pharmacopœia.

*Preparation.*—The two main steps in its preparation are (1) the precipitation of the citric acid as citrate of calcium ( $\text{Ca}_3''2\text{C}_6\text{H}_5\text{O}_7'''$ ); and (2), the decomposition of this precipitate by sulphuric acid, thus  $\text{Ca}_3''2\text{C}_6\text{H}_5\text{O}_7''' + 3\text{H}_2\text{SO}_4 = 3\text{CaSO}_4 + 2\text{H}_3\text{C}_6\text{H}_5\text{O}_7$ .

Lemon juice contains on an average about 32 or 34 grs. of citric acid in the fluid ounce. The lemon juice is first boiled, so as to coagulate the albuminous substances, and then saturated, *while hot*, with chalk:—

Citric Acid.                  Chalk.                  Calcic Citrate.



The deposit (citrate of calcium) is washed with *hot* water, because this precipitate dissolves in cold water, and is finally decom-

\* *Liquor Carbonis detergens*, an alcoholic solution of coal tar, is a black liquid, used externally as a lotion (℥ss. to 8 oz.) in some skin diseases.

posed by dilute sulphuric acid. Most of the sulphate of calcium produced is separated by filtration, and the citric acid is allowed to crystallise out slowly, care being taken to remove any further crop of crystals of calcic sulphate which may form. Too high a temperature during the concentration would cause decomposition of some of the citric acid, and the deposit of calcic citrate must not be allowed to stand long unacted on by the sulphuric acid, else it will undergo fermentation. Good lemon juice yields from  $2\frac{1}{2}\%$  up to 6% or even 10% of pure acid, but the quantity varies greatly, for when lemons are kept for some months, the amount of citric acid decreases, at first slowly, but at length very rapidly, till not a trace of citric acid remains. The acid splits up into glucose and carbonic anhydride ( $\text{CO}_2$ ), and some acetic acid is formed. Citric acid has not yet been artificially prepared.

*Characters and Tests.*—The crystals are often large, and are permanent in dry air, but become moist in damp. Their sp. gr. is 1.6, and they have a strongly acid almost caustic taste, but, when diluted freely, are cooling and refreshing.

*Solubility.*—In glycerin, 1 in 2; in rectified spirit, 1 in 1.5.

A weak aqueous solution of it cannot be kept, as it becomes mouldy, and acetic acid is formed. Its most common *impurities* are tartaric acid and lime, the former detected by acetate of potassium (precipitate =  $\text{KHT}$ ). Like most organic substances it ought to be entirely combustible; any fixed impurity, such as lime, would remain as ash. If darkened by sulphuretted hydrogen, the presence of lead derived from the evaporating pans used on the large scale would be shown; sulphuric acid or any sulphate (e. g. alum) is detected by chloride of barium; oxalic acid by *cold* lime water. If the lime solution were hot, citrate of calcium would be deposited. Citrate of calcium is not dissolved by cold solution of potash, tartrate of calcium is, hence by this means citrates can be separated from tartrates.

When heated to  $212^\circ$  it loses its molecule of water of crystal-

lisation; a higher heat decomposes it, and aconitic and itaconic acids are produced. If pure, 70 grs. of the acid will neutralise 1000 gr. measures of the volumetric solution of soda (containing 1 molecule of  $\text{NaHO}$ ); for since 1 molecule of acid ( $= 210$ ), being tribasic, will saturate 3 molecules of soda,  $\frac{1}{3}$  of a molecule of acid, i. e. 70 grs. ( $\frac{210}{3}$ ), must saturate a single molecule of soda.

*In Pharmacy.*—Enters into the formation of the various citrates, the most important of which is the *Ferri et Quiniæ Citras*. All the citrates in the *Pharmacopœia* contain either an alkali or an alkaloid; the alkaline citrates are soluble; so are the acid citrates of the heavier metals, but the tribasic earthy citrates are mostly insoluble. In *Vinum Quiniæ* it serves to dissolve the sulphate of quinia, and, like tartaric acid, it prevents the precipitation of iron salts by alkalies, e. g. *Ferri et Ammoniæ Citras*.

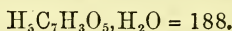
*In Medicine.*—Chiefly used in the composition of effervescing mixtures; it is well borne by the stomach, and in some irritable states of that organ affords considerable relief. Twenty grains of the crystals neutralise 28 grains of bicarbonate of potassium, or 24 grains of bicarbonate of sodium. But tartaric acid is commonly employed as a substitute on account of its greater cheapness. The physiological action of citric acid is essentially similar to that of tartaric acid.

Largely diluted, or in the form of *Liq. Ammon. Citratis*, it forms a cooling and sedative drink in febrile and inflammatory diseases, and is sometimes used for making a substitute for lemonade; 20 grains of the acid, in a pint of water, sweetened with sugar which has been rubbed on fresh lemon peel. Citric acid curdles the milk of most animals, but does not produce that effect on human milk. (Paris.)

In the form of lemon or lime juice it is most valuable in the treatment of scurvy; and, what is more important, is prophylactic of it. Taken freely, it causes a temporary increase in the acidity of the urine, and gives a deposit of free uric acid. Citric

acid (lemon juice), freely given, has been specially recommended in acute rheumatism.

### ACIDUM GALLICUM.



*Origin.*—Of the two astringent acids, gallic and tannic, which occur in galls, the first is crystallisable in delicate, silky needles, the second is uncrystallisable. It is probable that the gallic acid is entirely derived from the decomposition of some of the tannic acid. (See Galla.)

*Preparation.*—The Pharmacopœial process consists essentially in exposing a thick paste of powdered galls to the air for *six weeks*, at a temperature of 60° or 70° F., taking care to keep the mass in a moistened condition. During this time it is believed that the pectase, a substance found in galls, and which acts as a ferment, gradually transforms the tannic acid of the nut-galls, under the influence of oxygen, into gallic acid and grape sugar:— $\text{C}_{27}\text{H}_{22}\text{O}_{17}$  +  $4\text{H}_2\text{O}$  =  $3\text{C}_7\text{H}_6\text{O}_5$  +  $\text{C}_6\text{H}_{12}\text{O}_6$ . The sugar is ultimately oxidised into alcohol and carbonic acid gas, or, almost entirely into carbonic gas and water:— $\text{C}_6\text{H}_{12}\text{O}_6$  +  $6\text{O}_2$  =  $6\text{CO}_2$  +  $6\text{H}_2\text{O}$ . It appears, then, that gallic acid is a product of a species of fermentation in the galls, and the experiments of Wittstein are confirmatory of this view. Since gallic acid is sparingly soluble in cold water, it is extracted from the altered galls by boiling water, and the hot solution, as it cools, deposits the acid in crystals. It is not easy to obtain the acid perfectly colourless without filtering the boiling solution through purified animal charcoal. The amount of gallic acid obtained from galls is about 20 or 30%.

*Characters and Tests.*—Its crystalline condition at once distinguishes it from tannic acid, which is amorphous. Though very slightly soluble in cold water, alcohol takes it up readily, and glycerin (40 grains to  $\frac{3}{4}$ ) makes with it a clear solution



which, being miscible with water, is well suited for local application, and has been adopted in the Pharmacopœia (Glyc. Ac. Gallici.) Ether dissolves it very imperfectly. It is possessed of a sweetish acid taste, without much astringency. Its aqueous solution reddens litmus paper, and does not precipitate solutions of gelatin (isinglass), albumen, or the salts of the alkaloids, in which particulars it differs essentially from tannic acid. (See table under Acidum Tannicum.) When mixed with gum it precipitates gelatin. On the other hand, like tannic acid, it precipitates persalts of iron (ferric salts) of a blueish black colour, which disappears on heating, owing to the formation of metagallic acid. Ferrous salts also are gradually blackened by gallic acid. Its solution undergoes spontaneous decomposition when exposed to the air; but the addition of a drop of oil of cloves is stated to preserve the solution for a long time.

When dried at  $212^{\circ}$  it loses its molecule of water of crystallisation, and therefore  $9\frac{1}{2}\%$  of its weight; for,  $188 : 18 :: 100 : x = 9.57$ . By a red heat, with access of air, it is entirely dissipated, but when carefully heated to  $410^{\circ}$ , a new compound, pyrogallie acid ( $C_6H_6O_3$ ), sublimes in light feathery crystals. This acid gives a red colour with ferric salts, and deep blue with ferrous salts. Gallic acid has been synthetically prepared.

*In Medicine.*—Its properties are those of a pure astringent, and as it does not, like tannic acid, form insoluble combinations with gelatinous and albuminous substances, it is particularly adapted for internal administration, apart from its local action. Its presence in the urine soon after administration is readily manifested by a dark colour on the addition of a few drops of Tinct. Ferri Perchlor. It is frequently used for arresting hemorrhages, which must be reached through the route of the circulation, especially in cases of bleeding from the lungs, uterus, and urinary passages, and it is the essential ingredient of the nostrum called Ruspini's styptic. It is also beneficial in

the treatment of chronic diarrhœas, and in the distressing night sweats of phthisis, and does not possess, at least to the same degree, the constipating property which belongs to tannic acid. Much benefit is attributed to it in the treatment of albuminuria, and of chylous or fatty urine. Though the Glycerinum Ac. Gall. may be employed as a topical remedy, it is inferior in that respect to the corresponding preparation of tannic acid. The most usual mode of administering the acid is in the form of pill or powder, and the latter form is best when full doses, 10 to 15 grains, are ordered.

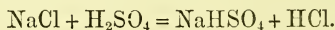
### ACIDUM HYDROCHLORICUM.

$$\text{HCl} = 36.5.$$

The hydrochloric or muriatic\* acid of pharmacy is a solution of hydrochloric acid gas in water forming nearly 32% by weight of the solution.

*Preparation.*—Being a volatile acid, it can be prepared from any chloride (muriate) by distillation with the less volatile sulphuric acid; and as the cheapest and most abundant chloride in nature is common salt, it is usually obtained from that source. Hence its old names of spirits of salt, and marine acid.

The sulphuric acid, after admixture with water, is allowed to cool before adding it to the chloride of sodium, in order to prevent too rapid extrication of gas. The following equation explains what occurs during the distillation:—



Acid sulphate of sodium, therefore, remains in the generating vessels, and may be afterwards applied to the formation of the neutral sulphate of sodium. (See Sodæ Sulphas.)

The disengaged gas is first passed through a wash bottle

\* *Muria*, brine.



to free it from any trace of sulphuric acid, and the receiver, containing the distilled water, must be kept cool during the whole operation, because, as the water becomes saturated, it increases in temperature, and its power of absorption is therefore lessened. Hydrochloric gas is extremely soluble in water, which is capable of taking up nearly 500 times its volume of the gas.

*Characters and Tests.*—The pure acid is colourless, but the commercial acid is yellowish, owing to the presence of a little organic matter, such as cork, wood, &c., or of ferric chloride, derived from the iron stills in which it is prepared. The iron may be detected by diluting the acid, neutralising with carbonate of sodium, and adding yellow prussiate of potash, when Prussian blue will be thrown down. Like other strong volatile acids it emits white fumes when exposed to the air, owing to the escape of the acid gas, and its union with the moisture of the atmosphere, forming a cloud of aqueous acid, but it does not undergo any decomposition. A rod dipped in Liq. Ammon., and held over a bottle of this acid, forms dense white fumes of sal-ammoniac ( $\text{NH}_4\text{Cl}$ ). This is sometimes used as a test for the acid, and *vice versâ*, but is not of much value. The sp. gr. varies with the strength; the strongest possible acid has a density of 1.21. Any fixed impurities, such as compounds of lead, will remain as residue when the acid is evaporated to dryness. The characteristic test for  $\text{HCl}$  (i. e. chloride of hydrogen), and indeed for any soluble chloride, is the formation with nitrate of silver of a curdy *white* precipitate of chloride of silver, *insoluble* in nitric acid, *soluble* in ammonia, and turning violet on exposure to light. The aggregate of these characters distinguishes chloride of silver from all other white precipitates. The volumetric test merely indicates the percentage of gas which the acid solution should include, for if 114.8 grains weight are exactly neutralised by 1000 grain-measures of the soda solution (which contain 1 molecule  $\text{NaHO} = 1$  molecule  $\text{HCl} = 36.5$ ), then,  $114.8 : 100 :: 36.5 : x = 31.8\%$ .

The possible impurities for which tests are provided in the Pharmacopœia are, sulphuric acid, lead, arsenic, and sulphurous acid. Chloride of barium would precipitate white with the sulphuric acid; sulphuretted hydrogen yellow with arsenic, or black with the lead; and bright copper foil boiled with the acid would be tarnished by a deposit of arsenic if it were present (Reinsch's test);  $\text{As}_2\text{O}_3 + \text{Cu}_6 + 6 \text{HCl} = 6 \text{CuCl} + 3 \text{H}_2\text{O} + \text{As}_2$ . A most injurious impurity is sulphurous acid, which is sometimes present to a large extent, and this is detected by the test, which was explained under the head of acetic acid. (See Ac. Aceticum.)

*In Pharmacy.*—Several preparations, a list of which is given in the Pharmacopœia, contain free or uncombined acid, added for the purpose of keeping the respective substances (e. g. Liq. Arsen. Hydrochl.) in solution. It is used as a source of chlorine in the preparation of Pot. Chloras, and to liberate carbonic anhydride from marble in the preparation of Pot. Bicarb., and Sodæ Bicarb. When hydrochloric acid combines with metallic bases or a metal, it forms salts termed chlorides (formerly muriates), e. g.  $\text{ZnCl}_2$ , the H of the acid being replaced by the metal. All chlorides are soluble in water, except chloride of silver, white precipitate, and calomel (Hydrarg. Subchlor.) But when this, or any other acid, combines with an organic base or alkaloid, the H of the acid is *not* so replaced, and the hydrochloric acid combines in its integrity with the alkaloid, a hydrochlorate or muriate being formed, e. g. Morph. Hydrochl.

*In Medicine.*—Though occasionally employed externally as a caustic in some diseases of the skin and mucous membranes, especially in diphtheritic sore throats, cancrum oris, and phagedænic ulcerations, and in the diluted form as an adjunct to gargles, it is more usually exhibited internally in the diluted state. It is not so irritating or corrosive as sulphuric or nitric acid, and it causes a greyish slough to separate. It possesses antiseptic qualities. Like the other mineral acids, when taken freely diluted, it is astringent and in small doses tonic. Added

to aromatic or bitter infusions, e.g. cascarilla or calumba, it forms an agreeable and useful tonic mixture, and has been largely used as such in some forms of dyspepsia, in typhus, typhoid fever, and in scarlatina, and on account of its solvent powers, to counteract phosphatic deposits in the urine. It is considered to be preventive of the development of intestinal worms. Swallowed in the concentrated form, it is highly poisonous; magnesia or carbonate of sodium should be given as antidotes, while emollient and mucilaginous drinks may also be freely taken.

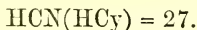
The dose for internal administration is about 10 or 20 minims of the dilute acid given in sweetened water or other convenient vehicle.

#### ACIDUM HYDROCHLORICUM DILUTUM.

This acid, like Ac. Nitr. Dil., contains in 6 fluid drachms exactly 1 molecule of acid, HCl.

Its medical properties and uses have been given above.

#### ACIDUM HYDROCYANICUM DILUTUM.



*Preparation.*—Prussic\* acid is nearly always obtained by the action of sulphuric acid on ferrocyanide of potassium (yellow prussiate of potash):—



Accordingly, half the cyanogen comes over as prussic acid; the other half remains in the retort as an insoluble whitish ferrocyanide of potassium and iron (Everitt's salt), mixed with acid sulphate of potassium. Excess of sulphuric acid must be avoided or there will be the risk of producing some formic acid, and

\* So-called because first obtained from the pigment, Prussian blue

during the process the condenser and receiver must be kept cool for obvious reasons. On account of its virulent poisonous properties the acid can only be employed in a very dilute state, and the test given at the end of the process will indicate when the acid is of standard strength, viz., 2%, for 10 grains of AgCy derived from 100 grains of the acid, will correspond to 2 grains of the pure liquid acid, i. e.  $\frac{1}{5}$  the weight of the cyanide, since the molecular weight of HCy (27) is almost exactly  $\frac{1}{5}$  the molecular weight of AgCy (134).

What is termed Scheele's acid contains about 5% of anhydrous acid, but its use should be discountenanced as it is variable in strength, and is liable to lead to dangerous mistakes. Scheele discovered prussic acid in 1782.

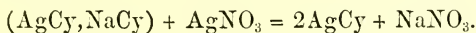
*Characters and Tests.*—Its sp. gr. is almost equal to that of water, hence, in this case, the minim (0.91 grains) and grain are practically identical, 100 grains weight will measure 110 minims. The odour is peculiar, and at once recalls that of laurel water. If the vapour of the medicinal acid be inhaled deeply once or twice, it causes a dry acrid sensation in the back of the throat, and soft palate, which soon passes off. Its taste is at first cooling, and afterwards irritating. Being a volatile and weak acid, it only slightly and transiently reddens litmus; a persistent redness would show some acid impurity (sulphuric or muriatic acid), which is sometimes, though unnecessarily, added for the purpose of preserving the prussic acid from change. The dilute acid will occasionally decompose if exposed to light, but can easily be kept unchanged in a bottle covered with black paint or black paper. Blue glass bottles are also commonly used for the same purpose.

The officinal colour-test consists in the formation of Prussian blue, a kind of ferrocyanide of iron itself. Potash is first added to form KCy; this, with sulphate of iron (ferrous salt) forms ferrocyanogen, which then combines with the persulphate (ferric salt) to form Prussian blue. The solution must finally be acidu-

lated with hydrochloric acid in order to dissolve any excess of the precipitated oxides of iron, which obscure the colour of the Prussian blue. Besides this "blue" test, a very delicate "blood-red test" is obtained by adding to the acid a little ammonia and yellow sulphide of ammonium. Evaporate cautiously to dryness, acidify with muriatic acid, and touch with a drop of ferric salt; a fine red colour is immediately developed, viz., ferric sulphocyanide,  $\text{Fe}_26\text{CyS}$ . (Liebig.)

Should the acid give no precipitate with chloride of barium, it is free from sulphuric acid, but with nitrate of silver it gives a white precipitate of cyanide ( $\text{AgCy}$ ), which is entirely soluble in boiling strong nitric acid, and thus distinguished from  $\text{AgCl}$ . Thus, we have three qualitative tests for prussic acid:—(a), *Red*, by conversion into ferric sulphocyanide; (b), *White*, with nitrate of silver; (c), *Blue*, by conversion into Prussian blue. The volumetric estimation of prussic acid is effected by Liebig's well-known method.

This consists in adding a standard solution of nitrate of silver to an alkaline (soda) solution of the acid (i. e. to  $\text{NaCy}$ ) until a permanent precipitate of cyanide of silver begins to form. The  $\text{AgNO}_3$  forms with the  $\text{NaCy}$  a *soluble* double cyanide of silver and sodium; thus,  $2\text{NaCy} + \text{AgNO}_3 = (\text{AgCy}, \text{NaCy}) + \text{NaNO}_3$ . But as soon as all the  $\text{NaCy}$  is converted into the double cyanide, the next drop of nitrate of silver solution in excess will cause a permanent precipitate of cyanide of silver, by decomposing the double cyanide:—



Since then, 1 molecule of  $\text{AgNO}_3$  (= 170) neutralises 2 molecules of  $\text{NaCy}$ ; i. e. 2 of  $\text{HCy}$  (= 54); 1000 grain measures of the standard silver solution, which, for convenience, contain only  $\frac{1}{10}$  molecule of  $\text{AgNO}_3$  (= 17), will correspond to  $\frac{1}{10}$  of  $2\text{HCy}$  (= 5.4), and this amount, in 270 grains weight of the officinal acid = 2% by weight.

*In Pharmacy.*—Used as a test for calomel. It is the active ingredient of Aq. Lauro-Cerasi.

*Toxicology.*—The pure acid possesses tremendous energy, and acts with extreme rapidity, and many cases of death have occurred even from the dilute acid. Death commonly ensues within a very few minutes, and though the acid is such a volatile substance, it may be found in the stomach for some days afterwards. It is a powerful sedative to the nervous and vascular systems, and hence the treatment to be adopted in a case of poisoning consists in the inhalation of a weak solution of chlorine or of ammonia. Cold affusion to the head and spine has also proved successful, and as a direct antidote, Messrs. T. and H. Smith have recommended an alkaline ferruginous solution which operates by converting the poison into insoluble Prussian blue. The patient is directed to swallow first a solution of carbonate of potassium (20 grains to 3j.), and immediately afterwards the mixed chalybeate solution (10 grains of sulphate of iron and 3j. of Tinct. Ferri Perchlor. to 3j. water). It is probable that the hypodermic injection of Liq. Ammoniae would be of service. M. Preyer proposes the subcutaneous injection of a small dose of sulphate of atropia as an efficient antidote.

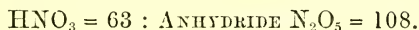
*In Medicine.*—The uses of hydrocyanic acid are mainly those of a nerve-sedative and anodyne. It is extensively employed in affections of the respiratory organs, and is a most valuable palliative in the cough of phthisis, and in other chest diseases attended with irritative dyspnoea or cough, e. g. hooping cough, asthma. It is in general favour for relieving certain affections of the stomach and intestines characterised by pain and spasm, and often accompanied by vomiting, and is, for that purpose, frequently combined with the subnitrate of bismuth.

*Externally,* it often gives important aid in allaying troublesome itching, e. g. in prurigo, lichen, eczema, and acne, and may either be added to a lotion or applied *per se*. The usual initial dose of the dilute acid is 2 or 3 minims, gradually in-



creased if necessary. The vapour arising from 10 – 15 m. of the acid mixed with a little cold water (Vapor Ac. Hydrocy.) may be inhaled with benefit in some cases of irritation or spasm in the air-passages.

### ACIDIUM NITRICUM.



Nitric acid is the highest oxide of nitrogen, and from it or its salts, directly or indirectly, all the lower oxides of nitrogen are prepared. Its common name, spirit of nitre, reminds us of its source, and since its most abundant and cheapest compounds are nitrate of potassium (saltpetre—prismatic nitre) and nitrate of sodium (Chili saltpetre—cubic nitre), both occurring in the surface soil of tropical countries, it is always prepared from one of these salts. Being a volatile acid it is obtained by distilling the nitrate with the less volatile sulphuric acid, and the reaction which occurs is simple,  $\text{KNO}_3 + \text{H}_2\text{SO}_4 = \text{HNO}_3 + \text{KHSO}_4$ . The acid (bi-)sulphate of potassium which remains in the retort can be readily converted into neutral sulphate (Potassæ Sulphas) by saturating its solution in water with carbonate of potassium and crystallising out (*cf.* Sodæ Sulphas). If only half the quantity of sulphuric acid, or, double the quantity of nitrate of potassium, were employed, a residue of neutral sulphate of potassium ( $\text{K}_2\text{SO}_4$ ) is left behind, which is hard, and not easily dissolved out of the retort. Moreover, in this case, a higher heat is required which involves decomposition and loss of some of the nitric acid.

*Characters and Tests.*—When pure it is colourless, but the commercial acid is reddish or yellowish, owing to its containing some of the orange gas  $\text{NO}_2$  (peroxide of nitrogen). The sp. gr. of the officinal acid is now reduced from 1·5 to 1·42, because a stronger acid than this is unstable, and is constantly undergoing decomposition under the influence of light. Acid of the sp. gr.

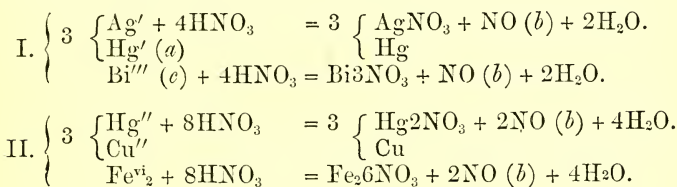
1.42 corresponds to the definite hydrate  $2\text{HNO}_3 \cdot 3\text{H}_2\text{O}$ , and distils over at  $250^\circ \text{F}$ . without change. When either stronger or weaker than this the acid distils at a lower temperature, and by losing respectively more acid or more water, tends to approach the density of 1.42 when the stable hydrate remains.

The white fumes it emits on exposure are caused by the combination of its invisible vapour with the moisture of the air, so as to form a cloud of minute drops, as with hydrochloric acid. A good *test* for nitric acid is its action on metallic copper or iron. When undiluted, dense red vapours of  $\text{NO}_2$  and other oxides of nitrogen ( $\text{N}_2\text{O}_3$  and  $\text{HNO}_2$ ) are immediately formed; but if it be first diluted, a colourless gas, nitric oxide ( $\text{NO}$ ) is given off, which acquires an *orange-red* colour, as it mixes with the air, for  $\text{NO} + \text{O} = \text{NO}_2$ . If the colourless gas,  $\text{NO}$ , be passed into a solution of sulphate of iron (green vitriol), or any ferrous salt, it will colour the liquid dark purple or brown, owing to combination of the  $\text{NO}$  with a portion of the iron salt. This latter phenomenon is a very delicate test for the presence of nitric acid; but, if applied to metallic nitrates, e.g. nitre, a few drops of strong sulphuric acid must, of course, be previously added in order to liberate the nitric acid. The most common impurities of this acid are sulphuric acid and hydrochloric acid. They are detected respectively by adding separately to the diluted acid chloride of barium and nitrate of silver, when a white precipitate, insoluble in acids, would in each case be formed.

The strength of a specimen of nitric acid is determined volumetrically by ascertaining how much standard soda solution is requisite to saturate a given weight or volume of the acid. Since nitric acid is monobasic, 1000 grain measures of the soda solution (which contain 1 molecule of soda,  $\text{NaHO}$ ) will exactly neutralise 1 molecule of  $\text{HNO}_3 = 63$ . Therefore, if 90 grains weight of the B. P. acid require 1000 measures of soda solution, there must be 70% of nitric acid present, for  $90 : 100 :: 63 : x = 70\%$ .



*In Pharmacy.*—Nitric acid is a powerful oxidiser, and is used in preparing several nitrates, most of which are obtained by the direct action of the acid on the particular metal. It oxidises all the ordinary metals except gold and platinum; and all the metalloids except oxygen, chlorine, bromine, and nitrogen decompose nitric acid, and take part of its oxygen. The subjoined scheme shows the relative proportions of acid and metal in the commonly occurring cases, for example, in the officinal nitrates. It will be observed that the amount of acid engaged in the reaction is always either 4 or 8 molecules, and that the quantity of metal depends on its atomicity. Thus, taking the action on a monad metal, e.g. silver, as the type-reaction, the metals may be arranged in two sets; on the one hand, 3 atoms of a monad, or its equivalent, 1 atom of a triad metal; and on the other, 3 atoms of a dyad, or 2 atoms of a triad metal.



(a.) In mercurous (sub) salts, Hg acts as a monad.

(b.) Though NO (nitric oxide) is disengaged, in reality it is nitrous acid ( $\text{HNO}_2$ ) that first arises, but which, on contact with water, is decomposed into  $\text{HNO}_3$  and NO. A small quantity of ammonium nitrate is always formed at the same time (Naquet).

(c.) Bismuth, by analogy, belongs to the pentads, but usually behaves as a triad.

From this we see that whenever the atomicity (or quantivalence) of the metal is *odd*, 4 molecules of nitric acid intervene; when *even*, 8 molecules.

All neutral nitrates are soluble in water, and hence there is no precipitation test for nitric acid. A few basic nitrates are insoluble, e.g. *subnitrate* of bismuth. Strong nitric acid is used

as a test for brucia (see Strychnia) and for morphia (see Morph. Hydrochlor.), both of which it turns of an orange or blood-red colour. It is commonly employed in testing urine for albumen.

Strong nitric acid acts energetically on certain organic substances, and produces compounds, "nitro-derivatives," in which  $\text{NO}_2$  (peroxide of nitrogen) is substituted for part of the H of the organic body, molecule for atom, e. g. Pyroxylin (gun-cotton). Nitrobenzol (artificial oil of almonds) and nitro-glycerin are additional familiar examples of these compounds. Nitrite of amyl is prepared by the action of nitric acid on amylic alcohol.

*In Medicine.*—The concentrated acid (aqua fortis) is a powerful and manageable caustic, and is much used in the treatment of soft chancres, poisoned wounds, cancrum oris, sloughing phagedæna, hemorrhoids (Houston), warts, prolapsus ani, &c. It acts rapidly, the pain caused is short-lived, and the raw surface remaining afterwards is generally disposed to heal quickly. It can be safely applied by a slip of pine-wood, moistened with the acid, and any excess of acid can be at once removed by dashing some cold water over the part, or better still, a weak solution of carbonate of soda. The acid quickly turns the skin of an indelible yellow (xantho-proteic acid), which is rendered brighter by the action of an alkali or of soap. Mucous membranes are coloured brown or greyish.

As a stimulant lotion, or gargle, the diluted acid (12 to 60 m. in a pint) has been found serviceable in superficial indolent ulcers of the extremities, and in ulceration of the mouth and gums.

Internally, it is tonic and astringent, and is recommended in the diarrhœa of children; and, on account of its solvent powers, has been advised in the treatment of phosphatic deposits in the urine. Largely diluted and suitably flavoured it forms an agreeable acid drink in low forms of fever, and Dr. Gibb and others consider it very efficacious in the treatment of whooping-cough.

Ten to 15 m. of the diluted acid, still further reduced with

water, are sufficient three or four times a day; and, in order to save the teeth, it is recommended to wash the mouth after each dose.

### ACIDUM NITRICUM DILUTUM.

When the strong acid is diluted with water, much heat is evolved, though less than is the case with sulphuric acid. Like the other dilute mineral acids it is so diluted that 6 fluid drachms will neutralise 1000 grain measures of the standard soda solution (= 1 mol. NaHO), i. e. they contain 1 molecule of  $\text{HNO}_3$  ( $= \frac{1}{2}$  mol.  $\text{N}_2\text{O}_5$ ). The percentage of  $\text{HNO}_3$  in the dilute acid is 17.44.

Its uses in medicine have been given above.

### ACIDUM NITRO-HYDROCHLORICUM DILUTUM.

*Preparation.*—When strong hydrochloric and nitric acids are mixed, they mutually decompose, and the mixture acquires the power of dissolving gold (“rex metallorum”), and hence it is termed *aqua regia*. It is also frequently named nitro-muriatic acid.

The strong acids are allowed to remain undiluted for twenty-four hours in order to ensure complete decomposition and the full development of free chlorine to which the solution chiefly owes its active solvent powers.  $2\text{HNO}_3 + 6\text{HCl} = 4\text{H}_2\text{O} + 2\text{NO} + 3\text{Cl}_2$ . At the same time two compounds, chloronitric gas ( $\text{NOCl}_2$ ) and chloronitrous gas ( $\text{NOCl}$ ) are also formed by the gradual union of the NO and the Cl. If the acids be diluted before being mixed, the same reaction occurs, but is not complete for a week or a fortnight.

*Characters and Tests.*—This acid is a colourless or yellowish liquid possessing the odour of chlorine. Since it is volatile, and is decomposed by light, it should be kept in a cool, dark place. Its saturating power is a little below that of the other dilute acids, for 6 fluid drachms of it require for neutralisation only 920 grain measures of the soda solution.

*In Pharmacy.*—A mixture of nitric and hydrochloric acids is used for making solution of chloride of gold, App. II.

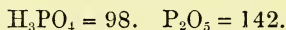
*In Medicine.*—This compound acid possesses the tonic and stimulating qualities of the other dilute mineral acids, and forms an agreeable and useful addition to bitter tonic mixtures. It has been chiefly recommended in oxaluria, some forms of chronic dyspepsia, and in advanced stages of syphilis.

Its continued use is said to occasion thirst, soreness of the gums, and salivation.

Externally, it was warmly advocated by Dr. Scott in the form of a local or general bath in chronic hepatitis and syphilis, but this practice has not come into general use.

The usual dose is about 5 m., largely diluted with water, but it is doubtful whether it possesses any material advantages over the simple acids which justify its retention in practice.

### ACIDUM PHOSPHORICUM DILUTUM.



*Preparation.*—When phosphorus is burned in dry air or in oxygen gas, it combines directly with the oxygen, and produces dense white fumes of phosphoric anhydride,  $\text{P}_2\text{O}_5$ , which, when dissolved in boiling water, are converted into ordinary phosphoric acid. But in the officinal process, the phosphorus is oxidised in the moist way by nitric acid, thus,  $3\text{P} + 5\text{HNO}_3 + 2\text{H}_2\text{O} = 2\text{H}_3\text{PO}_4 + 5\text{NO}$ . The nitric acid is first diluted in order to moderate the otherwise energetic reaction. If there be an insufficiency of nitric acid, some phosphorous acid ( $\text{H}_2\text{PHO}_3$ ) will be formed, and if the heat during evaporation be carried too high, pyro- and meta-phosphoric acids ( $\text{H}_4\text{P}_2\text{O}_7$  and  $\text{HPO}_3$ ) may be produced owing to elimination of the elements of water, for  $2\text{H}_3\text{PO}_4 - \text{H}_2\text{O} = \text{H}_4\text{P}_2\text{O}_7$ , and  $\text{H}_3\text{PO}_4 - \text{H}_2\text{O} = \text{HPO}_3$ .

Since some of the nitric acid rises in vapour unchanged, the distillate is collected and returned occasionally to the retort in

order to prevent loss. The liquid is concentrated by heat to a syrupy consistence to get rid of nitrous fumes, and finally diluted with water until it is of sp. gr. 1·08, = nearly 14%  $\text{H}_3\text{PO}_4$ . The latter stage of the evaporation must be carried on in platinum vessels because the strong phosphoric acid would corrode porcelain or glass vessels.

*Characters and Tests.*—The ordinary colour-test for the acid consists in adding ammonio-nitrate of silver, when a canary-yellow precipitate of phosphate of silver is thrown down.\* The precipitate is soluble in excess of ammonia or in free nitric acid, and hence the test solution must be carefully prepared.

All soluble phosphates give a white crystalline precipitate with sulphate of magnesium to which sal-ammoniac and solution of ammonia have been added. This precipitate is the ammonio-magnesian phosphate, well-known as “triple phosphate” ( $\text{MgNH}_4\text{PO}_4$ ). When heat is applied to common phosphoric acid, it loses water, and its first anhydride, pyrophosphoric acid ( $\text{H}_4\text{P}_2\text{O}_7$ ) is produced, thus  $2\text{H}_3\text{PO}_4 - \text{H}_2\text{O} = \text{H}_4\text{P}_2\text{O}_7$ . By a higher heat, more water is driven off, and its second anhydride, glacial or metaphosphoric acid ( $\text{HPO}_3$ ) is produced. The relation of these three varieties of phosphoric acid to each other will appear on examining their formulæ carefully:—

1. Common, or orthophosphoric acid, . . . .  $\text{H}_3\text{PO}_4$  Or,  $\text{H}_6\text{P}_2\text{O}_8$ .  
(Does not coagulate albumen; Yellow  
pp<sup>t</sup>. with ( $\text{AgNO}_3$ ,  $2\text{NH}_3$ ).
2. Pyrophosphoric acid, . . . . .  $\text{H}_4\text{P}_2\text{O}_7$  Or,  $\text{H}_4\text{P}_2\text{O}_7$ .  
(Does not coagulate albumen; White  
pp<sup>t</sup>. with ( $\text{AgNO}_3$ ,  $2\text{NH}_3$ ).
3. Metaphosphoric acid, . . . . .  $\text{HPO}_3$  Or,  $\text{H}_2\text{P}_2\text{O}_6$ .  
(Coagulates albumen; White pp<sup>t</sup> with  
( $\text{AgNO}_3$ ,  $2\text{NH}_3$ ).

\* Its analogue, arsenic acid, would give a chocolate-red precipitate.

That is, the varieties of phosphoric acid differ from each other by regularly diminishing proportions of water.

So,

$$(3) = (1) - \text{H}_2\text{O} :—$$

$$(2) = (1) - \frac{1}{2}\text{H}_2\text{O} ; \text{ i. e. } = (1) + (3), \text{ for, } \text{H}_3\text{PO}_4 + \text{HPO}_3 = \text{H}_4\text{P}_2\text{O}_7.$$

If the acid contain lead or copper, it will be precipitated black by sulphuretted hydrogen; if arsenic, yellow; if it contain sulphuric acid, white by chloride of barium; if it contain pyro-phosphoric or hydrochloric acid, dense white by nitrate of silver acidulated with nitric acid; and if metaphosphoric acid be present it will coagulate albumen. Should it, when partially dehydrated by sulphuric acid, darken a solution of sulphate of iron, nitric acid would be indicated, and, if phosphorous acid ( $\text{H}_3\text{PO}_3$ ) be present (owing to imperfect oxidation of the phosphorus) it will reduce perchloride of mercury, and give a deposit of subchloride (calomel):  
 $2\text{HgCl}_2 + \text{H}_3\text{PO}_3 + \text{H}_2\text{O} = 2\text{HgCl} + 2\text{HCl} + \text{H}_3\text{PO}_4.$

The strength of phosphoric acid cannot be accurately ascertained in the ordinary way by a volumetric solution of soda, because the phosphate of sodium that is formed, having an alkaline reaction, interferes with the observation of the point of saturation as evidenced by litmus. It is, therefore, estimated gravimetrically by adding a known weight of the acid to a known weight of oxide of lead in excess, whereby phosphate of lead is formed. Evaporate to dryness and weigh; the increase in weight of the oxide of lead corresponds directly to the amount of phosphoric acid present, which, in the officinal solution, is  $\frac{1}{2}$  a molecule of  $\text{H}_3\text{PO}_4$  (i. e.  $\frac{1}{4}$   $\text{P}_2\text{O}_5$ ) in 6 fluid drachms.

*In Pharmacy.*—This acid enters into the composition of several phosphates, of which the alkaline ones, viz. : phosphates of sodium and ammonium are soluble, while phosphates of calcium and of iron are insoluble. In *Syr. Ferri Phosph.* the free phosphoric acid serves to dissolve the precipitated phosphate of iron. Phos-



phoric acid is tribasic, and the constitution of its officinal compounds is:—

*Soluble—*

Ammoniaë Phosphas, . .  $(\text{NH}_4)_2\text{HPO}_4$ .  
Sodæ Phosphas, . . .  $\text{Na}_2\text{HPO}_4$ .

*Insoluble—*

Calcis Phosphas, . . .  $\text{Ca}_3\text{2PO}_4$ .  
Ferri Phosphas, . . .  $\text{Fe}_3\text{2PO}_4$ .

*In Medicine.*—Phosphoric acid, although chemically energetic as an acid, is not so corrosive as the other mineral acids. The diluted acid is tonic and refrigerant, and is less likely to irritate the digestive organs than other acids, and it is theoretically recommended in phosphatic deposits in the urine, these salts being soluble in an excess of acid. It will be recollected that it does not coagulate albumen or fibrin. Suitably flavoured it forms a pleasant acid drink, which has been used to allay the thirst of diabetes, and it is considered to be a stimulant to the sexual organs. Pavy states that when injected into the duodenum, it is capable of inducing a diabetic state of the urine. The usual dose is about 10 minims to commence with. This, the highest oxide of phosphorus, was the only oxide of phosphorus recognised in the Pharmacopœia of 1864, but two of the salts of hypophosphorous acid ( $\text{HPH}_2\text{O}_2$ ), are now officinal, and the pyrophosphates of iron, sodium, or ammonium, are occasionally prescribed.

## ACIDUM SULPHURICUM.

$\text{H}_2\text{SO}_4 = 98$ .  $\text{SO}_3 = 80$ .

Sulphuric acid occurs in the Pharmacopœia in 3 grades of strength, viz.:

Acidum Sulphuricum,	. . . .	96·80% $\text{H}_2\text{SO}_4$ .
„	„	aromaticum, 13·36 „
„	„	dilutum. . 13·64 „



The "Acidum Sulphuricum" is a little more than seven times as strong as the aromatic or dilute acid.

*Preparation.*—The acid is prepared on the large scale in leaden chambers by oxidising sulphurous acid gas ( $\text{SO}_2$ ) in the presence of water, by means of nitrous fumes, obtained by the action of sulphuric acid on nitrate of potassium or sodium. The sulphurous acid gas is produced either by the direct combustion of sulphur, or of iron pyrites ( $\text{FeS}_2$ ), and the first stage of the oxidation may be represented by the equation:  $3\text{SO}_2 + 3\text{H}_2\text{O} + 2\text{HNO}_3 = 3\text{H}_2\text{SO}_4 + \text{H}_2\text{O} + 2\text{NO}$ . The nitric oxide ( $\text{NO}$ ) is converted by the oxygen of the air into peroxide of nitrogen ( $\text{NO}_2$ ), which is deoxidised by more sulphurous acid, and reconverted into nitric oxide. Thus,  $\text{O of the air} + \text{NO} = \text{NO}_2$ ; and  $\text{H}_2\text{SO}_2 + \text{NO}_2 = \text{H}_2\text{SO}_4 + \text{NO}$ , and so the process goes on. As this oxidation and reduction of nitrous compounds goes on continually, it is clear that a small quantity of nitric oxide gas will act as a carrier of oxygen from the atmosphere to a large quantity of sulphurous acid. An excess of water is necessary, and when the process in the leaden chamber is completed, the dilute acid, of sp. gr. about 1.5, is drawn off and concentrated in leaden pans up to sp. gr. 1.7, and finally in glass or platinum vessels. In commerce the acid is transported in large demi-johns of green glass, called carboys, protected with a covering of straw or wickerwork. Altogether, then, the manufacture consists of four stages:—

- 1° Oxidation of sulphur into sulphurous acid.
- 2° Oxidation of sulphurous acid into sulphuric acid.
- 3° Concentration of the dilute acid in leaden pans.
- 4° Final concentration in platinum retorts.

*Characters and Tests.*—Pure oil of vitriol is colourless, and without odour, but the commercial acid is often dark coloured, owing to the presence of carbonaceous particles, resulting from the charring of fragments of organic matter, which had been accidentally introduced. It should never be kept in bottles

provided with cork stoppers; and it chars all oxyhydrocarbons, because it robs them of the elements of water, and reduces them to the state of carbon. Some bodies dissolve in sulphuric acid without blackening, e. g. indigo; others do not blacken, but are completely decomposed, e. g. oxalic acid. It has an energetic affinity for water, with which it forms definite compounds, one of them crystallisable. It undergoes considerable condensation, and much heat is evolved, when the acid is diluted. On account of its dehydrating powers, it is used in the laboratory as a desiccating agent in cases where it is desirable to avoid the application of heat. If sulphate of lead be present (derived from the leaden chambers or the evaporating pans), it will be deposited as a white powder on dilution, being insoluble in the diluted acid. Exposed to a moist atmosphere, sulphuric acid will absorb  $\frac{1}{3}$  of its weight of water in twenty-four hours, and six times its weight in a twelvemonth, so that an open bottle partially filled may, on exposure, ultimately overflow.

*Test.*—The smallest quantity of sulphuric acid, or of any soluble sulphate, can be detected by adding to the diluted solution a little chloride of barium. A dense white precipitate of sulphate of barium is formed, which is *insoluble in acids*, and is thus distinguished from other white precipitates which resemble it in appearance.  $\text{BaCl}_2 + \text{H}_2\text{SO}_4 = \text{BaSO}_4 + 2 \text{HCl}$ .

The strength of the acid is estimated, as usual, by a standard solution of soda; a given weight of the acid should require for neutralisation a certain number of measures of the soda solution. 1000 grain-measures of soda solution (containing 1 molecule  $\text{NaHO}$ ), will neutralise half a molecule of sulphuric acid, i. e. 49 grains ( $\frac{98}{2}$ ), because sulphuric acid is dibasic, but 50.6 grains of the officinal acid should contain exactly 49 grains of the pure acid (i. e. 98.8%), corresponding to 1000 gr. measures of soda solution.

The usual impurities of this acid are salts, nitrous oxides, and arsenic. Fixed salts, e. g. sulphate of sodium, are detected

by the residue left on evaporation. A solution of sulphate of iron (green vitriol) detects the nitrous compounds, by developing a purple colour, due to absorption of nitric oxide (NO) by the green vitriol. Should it contain arsenic (derived from the pyrites), a very common impurity, sulphuretted hydrogen will give with the diluted acid a yellow precipitate of orpiment ( $\text{As}_2\text{S}_3$ ); thus,  $\text{As}_2\text{O}_3 + 3 \text{H}_2\text{S} = \text{As}_2\text{S}_3 + 3 \text{H}_2\text{O}$ . The arsenic may also be detected by Marsh's hydrogen-test.

*In Pharmacy.*—On account of its greater fixity, sulphuric acid is frequently used in the preparation of other volatile acids, e. g. Acidum Hydrochloricum, Ac. Nitricum, Ac. Hydrocy., &c.; the less volatile sulphuric acid expels the more volatile nitric or hydrochloric acids, &c., from their salts.\* Used also as a source of hydrogen (Ferrum redactum), to prepare sulphuretted hydrogen (App. I.), and Sodæ Phosph. With bases, sulphuric acid forms a class of salts termed sulphates, of which 12 are officinal. Being dibasic (i. e. having two atoms of replaceable hydrogen), it can necessarily give origin to two classes of salts, viz.:—acid sulphates, e. g.  $\text{NaHSO}_4$ , in which only one atom of the acid hydrogen is replaced by a metal, and neutral (normal) sulphates, e. g.  $\text{Na}_2\text{SO}_4$ , in which both atoms of hydrogen are so replaced.

All the officinal sulphates are normal in composition, and generally contain water of crystallisation. The sulphates of iron, magnesium, quinia, and zinc, each contain 7  $\text{H}_2\text{O}$ . All the normal sulphates are soluble in water, except sulphates of barium, strontium, and lead, barium sulphate being the most insoluble; consequently, soluble barium salts are the appropriate test for the acid, and the precipitated sulphate of barium is a convenient form in which to weigh the acid for analytical purposes. Double sulphates, i. e. including two distinct metals, may also occur, of which alum is a familiar example.

\* Phosphoric, boracic, and silicic acids, however, can decompose the sulphates by the aid of heat, and expel the sulphuric acid on account of their higher fusing points.

*In Medicine.*—The concentrated acid is sometimes, but rarely, employed externally as a caustic, mixed with dried powdered sulphate of zinc, so as to form a paste (Sir J. Simpson), or with saffron (Velpeau), charpie, or powdered charcoal (Ricord's carbosulphuric caustic). It has no advantages, however, over other more manageable escharotics. When the strong acid is accidentally swallowed it behaves as an irritant and very corrosive poison. The treatment consists in the prompt administration of bicarbonate of potash or soda, magnesia and water, chalk, whiting, &c., or, if these are not obtainable, a solution of soap. After the poison has been neutralised by these alkaline substances, mucilaginous and other bland liquids should be freely given. Even after apparent recovery death is apt to supervene, owing to the development of stricture of the œsophagus, chronic vomiting, &c.

For *internal* administration the acid is always prescribed in the dilute form. It is tonic and astringent, and is frequently used in cases of debility with hectic sweats, in passive hemorrhages, and diarrhœas. Its efficiency is, perhaps, best seen in mitigating hectic perspirations, and controlling choleraic diarrhœa. It is a favourite and useful remedy in the treatment of lead colic, and other forms of saturnine poisoning, and is also justified in the treatment of phosphatic sediments in the urine; for, when taken in full doses, it increases the acidity of that secretion. In some skin diseases, especially lichen, prurigo, and chronic nettlerash, no remedy is so successful in relieving the distressing itching, formication, and tingling of the skin, as diluted sulphuric acid, taken internally (Pereira). About 10 minims are the average dose in water, or, in the more elegant form of the acid infusion of roses. To avoid injuring the teeth, it is recommended to suck the acid through a quill, or glass tube, or to previously rub a little butter over the teeth; but it is quite sufficient to rinse the mouth immediately with water, or with a weak alkaline lotion. It sometimes causes griping and diarrhœa when used too long; the addition of a little opium will counter-

act these effects. Under its use the milk of nurses may acquire a griping quality.

### ACIDUM SULPHURICUM AROMATICUM.

This preparation, commonly called *elixir of vitriol*, is a reddish brown liquid of an aromatic odour. It has been considered by some to contain a little ethylsulphuric (sulphovinic) acid generated by the action of the sulphuric acid on the alcohol, but it seems to be merely sulphuric acid, diluted with rectified spirit, and flavoured with the essential oils of cinnamon and ginger. It is a little weaker than dilute sulphuric acid.

*In Medicine.*—This “acid elixir” (Mynsicht) is a most agreeable and elegant form for the administration of sulphuric acid, and can, with advantage, be substituted for the ordinary dilute acid. It is often given in conjunction with cinchona, the taste of which it serves to cover, while it also promotes the solubility of the bark-alkaloids.

“Eau de Rabel,” a preparation esteemed in France, consists of sulphuric acid diluted with alcohol.

### ACIDUM SULPHURICUM DILUTUM.

*Preparation.*—The acid should be gradually *added* to the water to guard against the too sudden evolution of heat. Four parts by weight of acid, sp. gr. 1.84, and one part of water at 60° F., produce, when suddenly mixed, a temperature of 300°.

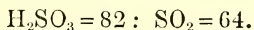
*Test.*—Six fluid drachms require for neutralisation 1,000 gr. measures of the soda solution (which contain 1 molecule NaHO), equivalent to 40 grs.  $\text{SO}_3$ , or 49 grs.  $\text{H}_2\text{SO}_4$  (i. e.  $\frac{1}{2}$  a molecule,  $\frac{98}{2}$ ), because sulphuric acid is dibasic.

*In Pharmacy.*—The acid occurs in small quantity in Infusum Rosæ Acidum, which is often used as a vehicle for sulphate of magnesium, constituting the “red mixture” of hospitals. It is commonly prescribed along with sulphate of quinia or the

preparations of bark for the purpose of dissolving the alkaloid, and the solution of quinia exhibits a fine blue fluorescence.

*In Medicine.*—See Acidum Sulphuricum.

## ACIDUM SULPHUROSUM.



*Preparation.*—As sulphuric acid was prepared by the oxidation of sulphurous acid, so the latter compound is readily obtained by deoxidising sulphuric acid. Copper or mercury is sometimes used as the reducing agent, but the cheapest means of obtaining the sulphurous acid gas is to heat wood-charcoal with sulphuric acid. In the cold, charcoal and sulphuric acid have little action on each other.  $\text{C} + 2\text{H}_2\text{SO}_4 = \text{CO}_2^* + 2\text{H}_2\text{O} + \text{SO}_2.$

The escaping sulphurous anhydride gas is first passed through a wash-bottle, to catch any impurities, e.g. sulphuric acid, and then conducted into a receiver full of distilled water, which, for obvious reasons, must be kept cold. The absorption of a little  $\text{CO}_2$  by the water is of no consequence.

*Characters and Tests.*—The officinal acid is a nearly saturated solution of sulphurous anhydride ( $\text{SO}_2$ ), and possesses a suffocating odour familiar to every one in burning a lucifer match. Water at  $65^\circ$  takes up about 50 volumes of the gas. Although the real acid ( $\text{H}_2\text{SO}_3$ ) can be obtained in crystals it is very unstable. Three hydrates can be obtained in crystals. The most characteristic properties of the acid are, that it is possessed of considerable bleaching powers and has a strong affinity for oxygen, with which it combines to form sulphuric acid. A solution of sulphurous acid of any considerable strength oxidises in partially filled bottles four times as rapidly in a light green bottle as when kept in one of dark blue (Umney). Dr. Redwood recommends the adoption of a 5% solution of the sulphurous

\* According to Wittstein,  $\text{CO}$  is formed.



acid gas as being more easily made and maintained of uniform strength. Solution of chlorine gas at once converts sulphurous into sulphuric acid,  $\text{H}_2\text{SO}_3 + \text{Cl}_2 + \text{H}_2\text{O} = 2\text{HCl} + \text{H}_2\text{SO}_4$ , and then, consequently, the solution will give with chloride of barium an abundant precipitate ( $\text{BaSO}_4$ ), which is insoluble in  $\text{HCl}$ . Before the chlorine is added, little or no precipitate is obtained, because *sulphite* of barium is soluble in weak hydrochloric acid. Sulphurous acid at once decolorises solution of iodine by forming with it hydriodic acid— $\text{H}_2\text{SO}_3 + \text{I}_2 + \text{H}_2\text{O} = \text{H}_2\text{SO}_4 + 2\text{HI}$ . This reaction is evidently exactly parallel to that of chlorine on sulphurous acid. On this reaction is based the volumetric estimation (Bunsen's process) of sulphurous acid by adding a known volume of standard solution of iodine to the acid, mixed with a little starch, until the presence of free iodine is shown by its striking a blue colour with the starch. Since 1 molecule of  $\text{H}_2\text{SO}_3$  or of  $\text{SO}_2$  (= 64) requires 2 atoms of iodine (=  $127 \times 2 = 254$ ), and since the volumetric solution of I contains, for the sake of convenience, only  $\frac{1}{10}$  of an atom of I (= 12·7 grs.) in 1,000 grain measures, it follows that 1,000 gr. measures of I solution will be exactly decolorised by 3·2 grs. of  $\text{SO}_2$ , i. e.  $\frac{1}{10}$  of an atom. Therefore, in the 34·7 grs. of the liquid acid directed to be tested there must be 3·2 grs. of  $\text{SO}_2$  i. e.  $9\cdot2\% = 11\cdot78\%$  of  $\text{H}_2\text{SO}_3$ . If the acid leave any residue after evaporation some fixed impurity (e. g. sulphates) is present.

With nascent hydrogen sulphurous acid gas forms sulphuretted hydrogen — ( $\text{SO}_2 + \text{H}_2 = \text{H}_2\text{S} + 2\text{H}_2\text{O}$ ), known by its putrid odour and by its blackening lead-paper. The test for sulphurous acid in acetic or hydrochloric acid (see these acids) is founded on this reaction.

*In Pharmacy.*—Although no compounds of sulphurous acid find a place in the Pharmacopœia, it enters into combination with bases to form sulphites, of which the sulphites of sodium, calcium, magnesium, &c., have been used.

*In Medicine.*—Most of the applications of sulphurous acid,

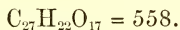


internal or external, are based on the fatal influence it exerts on the lower forms of animal and vegetable life, and on its power of arresting fermentation.

*Internally*, it was recommended by Dr. Jenner in the treatment of certain forms of stomach disease, such as pyrosis, attended with yeasty vomiting and the development of the minute organisms termed *sarcinæ ventriculi* (Goodsir). For this purpose the sulphite or hyposulphite of sodium is more suitable, either of which will yield free sulphurous acid by decomposition in the stomach. Dr. Polli, of Milan, has earnestly advocated the introduction of the sulphites into the treatment of zymotic diseases on the theory of their antiseptic powers, but his statements have scarcely as yet received sufficient confirmation from other observers.

*Locally*, the acid is a good deal used in the treatment of parasitic skin diseases (tineæ), such as ringworm, and may be applied by a sponge or piece of lint, and, if necessary, diluted with water or glycerin. It is also directed as a spray against gangrenous and phagedenic ulcers in the throat or vagina. Sulphur fumigations, i. e. fumes of  $\text{SO}_2$ , are sometimes employed against itch, chronic eczema, and other forms of skin disease.

## ACIDUM TANNICUM.



*Origin*.—Tannic acid (tannin) is defined simply as “an acid extracted from galls.” A glance at its formula shows that it differs from that of other acids in not having its basicity marked off, because, being uncrystallisable, it is difficult to obtain it in a perfectly pure state, or accurately to examine its relations with bases. The term *tannin* was originally applied to a principle or principles existing in many plants, including all the vegetable astringents, which precipitated gelatin white, and ferric salts black or green. But since Pelouze’s investigations, it is univer-

sally admitted to rank amongst the acids, and the term is now used as synonymous with tannic acid. There are several varieties of tannin which are named in accordance with their sources, e. g. gallo-tannic and quino-tannic acids, but the first is that which has been most accurately studied.\*

*Preparation.*—The process of the Pharmacopœia, which is that of Leconnet, consists essentially in exhausting powdered galls with ether mixed with a very little water. The ether, water, and tannic acid seem to unite to form a triple soluble compound, which is decomposed on evaporation, and deposits its tannic acid in an amorphous form. The curious circumstance is that tannin is insoluble in pure ether. The proportion of tannic acid in galls varies considerably, from 25–65%. English galls contain much less, only from 14–28%.

*Characters and Tests.*—The form in which tannic acid occurs, viz.:—in “vesicular masses or thin glistening scales” is a consequence of the mode in which it is dried in thin layers at an equable temperature. As the ether escapes, the residue froths up, and solidifies into a soft cellular uncrystallisable mass. The purified acid is white or nearly so, and it may be freed from its yellowish colour by filtering its solution in ether and alcohol through fresh animal charcoal. The slight smell which it possesses is due to a volatile odorous principle existing in the galls, and which can be separated from the acid by means of benzine. The taste is purely astringent without bitterness, and this acid, or some modification of it, is an essential component of all vegetable astringents. Tannin is very soluble in water, less so in alcohol, still less so in ether, especially when anhydrous, and insoluble in the fixed and volatile oils. Glycerin freely takes it up (Glyc. Ac. Tannici). It increases the

\* Tannin occurs in perennials rather than in annuals or biennials; it is abundant in barks, in the coats of fruits and seeds, and in unripe fruits, but is less common in leaves, rare in flowers, and is never found in the interior of seeds.

solubility of iodine in water. Tannin in the solid state is permanent, but if exposed to the air in solution, it gradually alters by oxidation, becomes turbid, and deposits a crystalline sediment of gallic acid. According to M. Robiquet this change is not inherent to the acid, but is due to the presence of a vegetable ferment, pectase, which exists in galls, and it is said that if the solution of tannic acid be boiled for a long time, so as to coagulate the pectase, the solution may be kept indefinitely without change. The two *tests* for tannic acid are the formation of a yellowish-white flocculent precipitate with gelatin or isinglass (or starch, albumen, or gluten), and a blueish-black\* precipitate with the *persalts* of iron. The amount of tannin in a liquid, e. g. an infusion, may be ascertained by determining the amount of a standard solution of gelatin which is precipitated by a given quantity of the liquid. The gelatin test distinguishes tannic and gallic acid, and the contrast in the general characters of these two acids will best appear by reference to the accompanying table :—

## GALLIC ACID.

Crystalline, in silky needles.  
Taste rough, feebly acid.  
Sparingly soluble in cold water.  
Gives no precipitate with gelatin,  
lime water, or the alkaloids.

## TANNIC ACID.

Amorphous masses or thin scales.  
Taste very astringent, not bitter.  
Readily soluble in cold water.  
Precipitates white with gelatin, lime  
water, and all the alkaloids.

Both acids precipitate bluish-black with ferric salts; no colour at first with pure ferrous salts.

Being an organic acid, it is entirely dissipated by a sufficient heat, and burns with a brilliant flame. When boiled with a

\* Some varieties of tannin (e. g. cinchona) afford a dark green precipitate with iron salts, while others (e. g. rhatany) give a grey precipitate.

dilute acid it yields glucose (grape sugar) and gallic acid, i. e. it is a glucoside— $C_{27}H_{22}O_{17} + 4H_2O = C_6H_{12}O_6 + 3C_7H_6O_5$ . Schiff considers that tannic acid is probably only the anhydride of gallic acid, and there is some reason to believe that commercial tannin contains some di-gallic acid.

No other variety of tannin, except gallo-tannic acid, is so convertible into gallic acid, neither will yield pyro-gallic acid when heated.

*In Medicine.*—Tannic acid is used solely on account of its astringent qualities. It is preferable to gallic acid for local purposes, but, on account of its affinity for proximate principles (albumen, &c.) it is not so readily absorbed from the mucous membranes. Over the astringent vegetable extracts it has the advantage of a smaller dose being required, thus being less liable to offend a delicate stomach. In the treatment of active hæmorrhages, bleeding from the rectum or uterus, it has been employed with great success, and in cases of diarrhœa, and of colliquative night sweats, it is a safe and unirritating astringent in doses of 5 grs. and upwards. Constipation, however, may follow its use in large quantities.

*Locally*, it is used for the general indications of astringents, viz.:—to check morbid discharges (i. e. as a styptic\*) and to counteract relaxation of tissue, especially of the mucous membranes. The suppository is a serviceable topical application in piles or relaxation of the lower bowel; and the lozenges are used with advantage in relaxed sore throat. Glycerin of tannic acid is sometimes a very useful injection in cases of gleet, and offers an appropriate and innocuous application for ophthalmic purposes. This preparation is a capital astringent in chronic eczema, and Dr. Ringer recommends it in the syphilitic affections of the nose in children, and in the nasal discharges which attend

\* Dr. B. Ward Richardson's "styptic colloid" is a saturated solution of tannin and gun-cotton in absolute alcohol and ether.

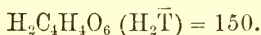
ozœna, and sometimes follow an attack of measles or scarlatina.

In passing through the system, tannin is converted into gallic and pyro-gallic acids, consequently, the urine of patients taking tannic acid turns black with a ferric salt, but does not precipitate gelatin.

In prescribing tannic acid, or preparations of galls, it is useful to remember that tannin affords precipitates with all the vegetable alkalies or alkaloids, such as morphia, and that it will also throw down many metallic salts, especially antimony. The alkaloidal precipitates are soluble in acetic acid. Gallic acid does not precipitate the alkaloids.

Tannin has been proposed as an antidote in cases of poisoning by the alkaloids, but as their tannates are slowly soluble, its efficacy is doubtful.

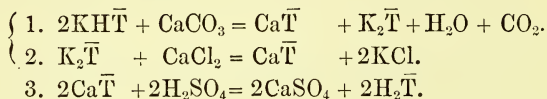
### ACIDUM TARTARICUM.



*Origin.*—Tartaric acid is one of the most widely diffused organic acids, and occurs partly free, partly as potassium or calcium salt, chiefly in fruits (berries). Tartaric acid can be artificially prepared in different ways. The commercial source of tartaric acid (i. e. tartrate of hydrogen) and of all other tartrates, is cream of tartar, the acid tartrate of potassium,  $\text{KHT}$ . This cream of tartar is itself derived from the juice of the grape, in which it is found in considerable quantity. When the grape-juice is fermented into wine, the acid tartrate of potassium, mixed with tartrate of calcium and colouring matter, is gradually deposited on the inside of the vessel, because the acid tartrate is insoluble in the alcoholic liquid. This crust, called *crude tartar* or “argol,” when purified, yields cream\* of tartar.

\* The term *cream* of tartar was originally applied to the crop of minute crystals which forms upon the surface of a solution of tartar, and which was skimmed off.

*Preparation.*—The main steps of the process are (*a*), to precipitate the whole of the tartaric acid as tartrate of calcium, and (*b*), to liberate the acid from this precipitate by means of sulphuric acid. The reactions that occur are as follows:—



The addition of chloride of calcium is requisite in consequence of half of the tartaric acid remaining, at first, in solution as neutral tartrate of potassium ( $\text{K}_2\bar{\text{T}}$ ) after the addition of the chalk. The sulphate of calcium which is formed being almost insoluble is mostly removed by filtration, and any trace which remains in solution crystallises out afterwards when the filtrate is concentrated.

*Characters and Tests.*—This acid, discovered by Scheele in 1770, occurs either in large, handsome, transparent crystals, or, usually, as a fine white powder, sp. gr. 1.75. The crystals are pyro-electric, and become luminous in the dark by friction. The crystals or the dry powder are permanent in the air, but weak aqueous solutions become mouldy by keeping, and acetic acid is formed. Similar decompositions occur with other vegetable acids, such as citric and acetic acids. The addition of a little rectified spirit tends to preserve the solution. (e.g. Solution of Tartaric acid, App. II.) It is readily soluble in water, whereas cream of tartar, if present as an impurity, would be detected by its sparing solubility in water or spirit. The usual *test* for tartaric acid consists in its giving a white crystalline precipitate ( $\text{KH}\bar{\text{T}}$ ) with acetate of potassium, especially when briskly agitated. This reaction, which distinguishes tartaric from other acids, and, in particular, citric acid, is not applicable to very dilute solutions, because the cream of tartar is not altogether insoluble; the addition of a little rectified spirit renders the test more delicate.



Tartaric acid, when neutralised by an alkali, also gives a white precipitate (tartrate of calcium), with chloride of calcium, which is soluble in cold liquor potassæ and is re-precipitated on boiling; another character which distinguishes tartaric from citric acid. Nitrate of silver with a neutral tartrate gives a white precipitate of tartrate of silver which blackens on boiling, owing to separation of metallic silver. Citrate of silver is not altered by boiling; and oxalate of silver is decomposed by heat with an explosive puff.

Tartaric acid is estimated quantitatively in the usual way by neutralisation with the volumetric solution of soda, and as the acid is dibasic, 75 gr. (i. e.  $\frac{1}{2}$  a molecule) will therefore neutralise 1,000 gr. measures of the soda solution (which contain one molecule of soda, NaHO).

The usual impurities are (*a*) lead, derived from the leaden crystallising vessels, and detected by sulphuretted hydrogen giving a black precipitate; (*b*) oxalic acid, if accidentally present, would be precipitated by sulphate of calcium (as also racemic acid, an isomer of tartaric acid); and (*c*) lime, detected by oxalate of ammonium.

*In Pharmacy.*—Tartaric acid enters into the formation of various officinal tartrates and the relations of their formulæ will appear from the subjoined table:—

Acidum Tartaricum, . . . . .	$\text{HHT}^{\bar{}} (\text{H}_2\text{T}^{\bar{}})$ .
Potassæ Tartras Acida, . . . . .	$\text{KHT}^{\bar{}}$
,, ,, (soluble tartar), . . . . .	$\text{KKT}^{\bar{}} (\text{K}_2\text{T}^{\bar{}})$ .
Soda Tartarata (Rochelle salt), . . . . .	$\text{KNaT}^{\bar{}}$ .
Antimonium Tartaratum (tartaremetic), . . . . .	$\text{K}(\text{SbO})\text{T}^{\bar{}}$ .

The two last formulæ illustrate the strong tendency of the acid to form double salts. All these tartrates are prepared from the acid tartrate of potassium by substituting their respective metallic radicals for the atom of acid hydrogen in  $\text{KHT}^{\bar{}}$ . It is to be observed that tartaric acid, as well as citric acid and other



non-volatile organic matters, e. g. sugar, prevent the precipitation of iron and other heavy metals by alkalies, e. g. Potassio-tartrate of iron (*Ferrum Tartaratum*), which is perfectly soluble. Tartaric acid also prevents the precipitation of antimonial salts by water (see *Liq. Antim. Chlor.*), but not so with bismuthic salts.

*In Medicine.*—A solution of tartaric acid sweetened is sometimes used as a substitute for lemonade, and, being cheaper than citric acid, it is a common constituent of acid refrigerant drinks, and especially of effervescing draughts and mixtures. 20 grs. of the acid will neutralise 26 grs. of Pot. Bicarb. and 22 grs. of Sodæ Bicarb. In large doses, tartaric acid acts as an irritant, and, while its flavour is not so agreeable as that of citric acid, it is said to be more apt to disorder the digestive organs and to produce colic. The addition of this acid serves to cover the taste of sulphate of quinia, senna, rhubarb, and Glauber's salt. "Soda powders" consist of 25 grs. of the acid in one paper and 30 grs. of bicarbonate of sodium in the other, which may be dissolved in separate portions of water, and then mixed in a tumblerful of water flavoured with syrup of ginger or orange peel. The so-called "lemonade powders" and "citratèd kali" contain tartaric acid, and not citric acid as their name would imply. If bicarbonate of potassium be added to tartaric acid, cream of tartar is immediately precipitated, but, if the acid be added to the bicarbonate, it may be pushed to the point of saturation and yet form a perfect solution.

The well-known Seidlitz powders (so named from the saline springs of Seidlitz, in Bohemia) consist as follows:—One powder, usually put up in a *white* paper, contains 35–40 grs. of tartaric acid, the other powder, put up in a blue paper, contains 40 grs. of bicarbonate of sodium mixed with 120 grs. of Rochelle salt. When mixed in solution, carbonic acid gas escapes with effervescence, and the salts actually swallowed are

Rochelle salt, neutral tartrate of sodium, and also some acid tartrate of sodium, because the acid is slightly in excess. These powders should be kept in a dry place. They are refrigerant and mildly aperient.

## ACONITI\* FOLIA.

## ACONITI RADIX.



*Origin and Characters.*—Two different parts of the aconite, or common monkshood, are indicated in the Pharmacopœia, viz., the fresh leaves and flowering tops, and the dried root.

The active principle, aconitia, is also employed in the isolated form.

The plant from which these are derived is the *Aconitum Napellus*,† N. O. Ranunculaceæ, which, though indigenous to the mountain forests of Europe, grows freely and is cultivated in Britain.

It is a tall, handsome plant, from two to four or five feet high, furnished with alternate, stalked, and palmately divided leaves. The flowers are violet blue, and are arranged in an elongated, upright raceme; the calyx is irregular, helmeted, and *petaloid*; and the petals are two in number, and hammer-headed, the rest being abortive.

The fresh plant is possessed of considerable acidity, and may even excite vesication when applied to the skin for any length of time.

The leaves and tops should be gathered before the flowers are fully expanded, as they are less efficacious after the fruit has formed; and they must also be *fresh*, because their medicinal activity is impaired by long keeping.

\* *Ἀκόντιον*, a dart, because used by barbarous nations to poison their arrows.

† Dimin: *napus*, a turnip, from the shape of its root—like a wild turnip.

The root is directed to be collected before the leaves appear, in order that it may not be exhausted by the spring shoots. The characters of the roots are important to bear in mind, as fatal mistakes have arisen through confounding it with horseradish or Jerusalem artichoke—a mistake that could only occur from gross ignorance or carelessness. Some time since several persons were poisoned in Constantinople through the root of *Aconitum ferox*—the deadly Bikh of the East Indies—having been accidentally sold for jalap. The *Aconitum ferox* is about three times as strong as the British plant.

The coffee-coloured exterior, the conical form rapidly tapering to a point, and the numerous fine fibres proceeding from its sides, sufficiently distinguish aconite root independently of taste or smell.

The characteristic physiological test for any part of this plant is the peculiar and *persistent* numbness and tingling perceived on chewing a small portion, and which is due to the presence of aconitia. According to Christison, the leaves lose this property entirely by the time the seeds are ripe. The seeds are then intensely acrid.

The only important constituent of monkshood is aconitia, defined to be an alkaloid or basic active principle.

### ALKALOIDS.

There are two classes of active principles; the one, *basic*, i. e. forming salts with acids, and to which the termination “ia” is restricted in the Pharmacopœia.

These are the true alkaloids, viz.: Aconitia, Atropia, Bebeeria, Morphia, Quinia, Strychnia, and Veratria.

The other class is *non-basic*, i. e. not forming definite compounds with acids, and is officially distinguished by the termination “in,” or “um,” e. g. Digitalin or Digitalinum. Aconitia being the first instance we meet of an alkaloid, it will be well to take a

brief glance once for all at the general characters of this very important class of bodies.

The natural alkaloids or vegetable bases form a group of peculiar substances generally distinguished by their potent physiological action, while, in their chemical analogies, they resemble ammonia more or less, and, in ultimate composition, are ternary, consisting of C, H, and N (volatile); or, in the majority of cases, are quaternary, and contain C, H, N, and O, (fixed alkaloids).

All our knowledge regarding these organic bases dates from this century, for the first alkaloid which was definitely isolated was morphia in the year 1816. At present more than 100 alkaloids are known to exist distributed through a comparatively small number of Natural Orders which, with scarcely an exception, are dicotyledonous. Some of the largest Natural Orders, e. g. *Compositæ* and *Labiataæ* are as yet unrepresented among the alkaloids, and, as a rule, the same alkaloid is not diffused through several Natural Orders, and may not even occur in all the species of the same genus, e. g. *Strychnos*.

The alkaloids seldom or never occur free, but usually in the form of salts, and often as acid salts, the acid being frequently malic or tannic, and sometimes, as in the case of meconic acid, peculiar to the family of plants in which the alkaloid is found. All the alkaloids, except conia, nicotia, trimethylia, and one or two others, are solid bodies, and are fixed or non-volatile at ordinary temperatures. By great care, however, minute quantities of the so-called fixed alkaloids can be sublimed unchanged. The volatile alkaloids, e. g. conia, are clear fluids, with an intense and characteristic odour, and by contact with air they become darker from oxidation. They are readily soluble in spirit of wine, ether, and chloroform. The fixed alkaloids usually crystallise, although some of them, e. g. aconitia and veratria, are commonly obtained in an amorphous form. As a

rule, they are sparingly soluble in water, and are all soluble in spirit of wine.

Like ammonia-gas, the alkaloids combine with dilute acids without elimination of water; thus, the formula of hydrochlorate of morphia is  $\overset{+}{M}$ , H Cl. Almost all alkaloids are precipitated by tannic, picric, and phospho-molybdic acids, likewise by solutions of iodine in iodide of potassium (e. g. Tinct. Iodi), and mercuric iodide in potassic iodide ( $HgI_2$ ,  $2KI$ .) These reagents are very useful in an analytical point of view.

In their chemical *constitution* the alkaloids belong to the class of "compound ammonias," or amine and amide-bases, i. e. ammonia, one or more molecules, in which the hydrogen has been wholly or partially replaced by organic radicals, oxygenated or not, but their precise chemical *structure* has not yet been unravelled, and hence empirical formulæ alone are possible. All the fixed alkaloids appear to be tertiary amines, the volatile are either secondary or tertiary derivatives.

Until very recently chemists had not succeeded in accomplishing the synthesis or artificial formation of any of the natural alkaloids. In 1870, Hugo Schiff made the first step by artificially producing conia, the active principle of hemlock, and it cannot reasonably be doubted that the artificial production of other alkaloids is merely a question of time.

*Administration.*—Alkaloids are prescribed:—

(a.) In solution: preferably in water, acidulated if need be to render the base or its compounds more soluble, e. g. Liq. Strychniæ. For ophthalmic use, always in simple watery solution, e. g. Liq. Atrop. Sulph.

(b.) In lozenges, e. g. Trochisci Morphiæ.

(c.) In pill, e. g. Pilula Quiniæ.

(d.) In powder, rubbed up with some inert vehicle such as milk-sugar.

(e.) In ointment, e. g. Ung. Veratriæ.

(f.) Endermically, on the cutis denuded by a blister, e. g. Morphia.

(g.) Hypodermically, e. g. Morphia, Atropia, Strychnia.

(h.) In the form of medicated paper or gelatin in thin lamellæ, e. g. atropised and calabarised gelatin and paper for ophthalmic therapeutics.

Solutions of most of the alkaloids are very prone to become mouldy by keeping, and to deteriorate in strength unless care be taken to prepare them from the finest materials dissolved in *pure* distilled water, or better still, in pure Aqua Camphoræ.

In prescribing alkaloids in solution internally, it should be a rule not to introduce any unnecessary mixtures, and to observe the greatest possible simplicity in the prescription in order to avoid precipitation.

## ACONITIA.

The mode of preparation of aconitia is unimportant, and its preparation is left in the hands of a few eminent pharmaceutical chemists; but the following remarks will explain the principal steps of the Pharmacopœial process:—

The aconitia ( $C_{30}H_{47}NO_7$ ?) exists in the plant in combination with aconitic acid ( $C_6H_6O_6$ ), and this natural salt of the alkaloid is dissolved out of the root by the rectified spirit, which is afterwards drawn off by distillation. From the aqueous solution of the residue the impure aconitia is precipitated by ammonia. The precipitate is dried and digested repeatedly in pure ether which does not take up the accompanying impurities.

On distilling off the ether from the extract, and dissolving the dry residue in acidulated water, the aconitia is again precipitated by ammonia, and finally washed and dried. The yield of aconitia from the root is differently stated, but, on the average, may be taken as about 0·5%. The best roots furnish 1·25%. The quality of aconitia varies greatly, that prepared in Ger-



many (Merck's) being much less active than the English (Morson's) or French alkaloids. Like all the alkaloids, it is scarcely soluble in water, but much more soluble in alcohol and ether.

There is no very characteristic chemical test for it; but it is one of the most energetic poisons:  $\frac{1}{30}$  grain will kill a sparrow in a few minutes;  $\frac{1}{20}$  grain has killed a cat. The alkaloid is prepared from the root, as that is the most active part of the plant. The wild plant is said to contain more of the active principle than that which is cultivated.

Much uncertainty has long prevailed upon the nature and properties of the different products sold under the name of "aconitine" or aconitia. It appears now that there are at least two distinct alkaloids, *aconitia* and *pseudaconitia*, the latter of which is much the more powerful. "English aconitia" seems to owe its reputation and powers to the presence or substitution of *pseudaconitia*. Quite recently M. Duquesnel has succeeded in extracting from monkshood a *crystalline* alkaloid,  $C_{27}H_{40}NO_{10}$ , which he believes to be the veritable active principle of the plant.

*In Pharmacy.*—The Liniment is eight times as strong as the Tincture.

*In Medicine.*—Although aconite has long been known as a powerful poison, it has not been in use for more than about one hundred years, and was brought into notice by Störck in 1762. In full doses it reduces and depresses the pulse; it is accordingly of use in some excited states of the circulation, and its action may be broadly stated as that of a nervo-vascular sedative. It has been largely used in the treatment of acute rheumatism; and, according to Dr. Ringer and others, its powers over inflammation are little less than marvellous, especially in the early stage, and when the inflammation is not very extensive or severe; for example, in acute tonsillitis, catarrhal croup, &c.

Since one effect of its general mode of action is to cause slowing of the pulse, and lowering of the temperature, aconite is administered with advantage in febrile states, and inflammatory



painful affections, and its depressing effect on the nervous system authorises its use in affections depending on cerebral excitation.

In poisonous doses it produces severe gastric irritation, numbness, loss of sensation, and muscular paralysis. Prompt evacuation of the stomach, and the use of stimulant remedies, internally and externally, are to be relied on, as we do not possess any certain antidote to its toxic properties. *Nux vomica* has been said to be physiologically antagonistic to aconite, and tannin and ioduretted iodide of potassium are the asserted chemical antidotes, forming insoluble compounds with the aconitia; but they cannot be trusted to, as their value is uncertain. Animal charcoal freely administered has been recommended by Dr. Garrod as an antidote to aconite, as well as to other vegetable poisons, on account of its power of taking up and rendering latent, as it were, the poisonous alkaloids, but its efficacy is doubtful.

Locally, it is one of the most valuable anodynes we have, as might be expected from its elective action on the nerves of sensation, and may be employed with great advantage in rheumatic and neuralgic pains, especially in *tic douloureux*, *sciatica*, *lumbago*, &c. If relief does not follow the first or second application, it is useless to persevere. The *Ung. Aconitiæ* (Morson's) is sometimes adopted in the treatment of the latter class of affections; but the liniment will be found to be a more convenient and a safer preparation. Neither preparation should be applied to a broken surface, lest dangerous consequences should ensue from absorption. Aconitia, introduced into practice by Dr. Turnbull, is very rarely prescribed internally in this country;  $1\frac{1}{10}$  gr. would be quite sufficient for the initial dose. The German aconitia has been more commonly ordered on the Continent, in doses of  $\frac{1}{6}$  to  $\frac{3}{4}$  grain in pill.

## ADEPS\* BENZOATUS.

## ADEPS PRÆPARATUS.

*Origin and Preparation.*—Hog's lard, mutton suet, cod liver oil, bees' wax, and spermaceti, are the only animal fats in the Pharmacopœia.

Lard is the internal abdominal fat of the pig, *Sus scrofa*, Order Mammalia, deprived of peritoneal membrane, and purified by washing, melting, and straining through flannel. In its preparation the temperature should not be allowed to rise much above  $212^{\circ}$ , as otherwise partial decomposition of the lard might ensue, and acrid and coloured products result.

*Characters and Tests.*—A too scrupulous whiteness would suggest the admixture of alum or quicklime, which, of course, render the lard unfit for medical use. Both lard and suet liquefy at about  $100^{\circ}$ , the melting point of the latter being somewhat higher ( $103^{\circ}$ ). Its specific gravity is 0.88–0.93; all true fats are lighter than water.

When exposed to the air it absorbs oxygen and becomes rancid, certain acids being formed owing to the decomposition of some mucous and albuminous matters contained in the fat. This change, which unfits it for external use or for employment in pharmacy, may be obviated by adding to the melted lard a little benzoin (10 grs. to ʒj.), heating for two hours and straining. Hence the introduction of Adeps Benzoatus into the Pharmacopœia, an alteration which has proved of great value in the treatment of cutaneous affections. Perfectly pure fats and oils do not become rancid, and lard, if carefully prepared by repeated washings, meltings, and filtrations through *paper*, will keep quite sweet for many months, even when exposed frequently to the air.

\* *A*, from; *daps*, a feast. Synonym—Axunge; axis; unguo; because formerly used to grease the axles of wheels.

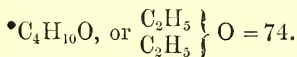
All fats are insoluble in water, but ether and the volatile oils readily take them up. Common salt is often added as a preservative, but is inadmissible if the lard be intended for pharmaceutical purposes. The salt may be removed by diligent washing with cold water, and is readily detected by the curdy white precipitate which it affords with nitrate of silver— $\text{AgNO}_3 + \text{NaCl} = \text{AgCl} + \text{NaNO}_3$ . If the lard contain starch it will respond to the iodine test, and if water be present, it will crackle when thrown into the fire. As much as 20% of starchy matter has been found in some specimens.

*In Pharmacy.*—Lard is almost exclusively used externally ; and since, when fused, it dissolves wax and resins, it serves a useful purpose as an ingredient of ointments and suppositories and is sometimes added to laxative enemata. It occurs in 29 out of the 34 “Unguenta,” viz.:—in all except Ung. Canthar., Cetacei, Hydr. Ox. Rubr., Picis Liq., and Plumbi Subacet. Comp.

*In Medicine.*—Lard is occasionally applied by friction to the body with the view of being absorbed and so promoting nutrition, and this method has been vaunted in the treatment of phthisis. It has been proposed to anoint the body of patients suffering from scarlet fever with the object of hindering the diffusion of the desquamating scales, the alleged carriers of contagion.

### ÆTHER.\*

ETHER.† (SULPHURIC ETHER‡).



In a general way, ethers may be considered as fragrant, volatile, and inflammable bodies usually prepared by the action

\* *Αἰθήρ*, air.

† The word *ether* was introduced into chemical language by Frobenius in 1720.

‡ A common but erroneous name, given to it in allusion to its mode of

of acids on alcohols. If the resulting ether contain none of the elements of the reacting acid, it is termed an "ether proper,"

e. g.  $\left. \begin{smallmatrix} \text{C}_2\text{H}_5' \\ \text{C}_2\text{H}_5 \end{smallmatrix} \right\} \text{O}$ , i. e. an oxide of an organic radical; if it contain

Cl, Br, or I (i. e. a non-oxygenated acid radical) in union with the alcohol radical, it is termed a "simple ether," e. g.  $\text{C}_2\text{H}_5\text{Cl}$ ; and, if it contain an oxygenated acid radical combined with the alcohol radical, it is called a "compound ether," e. g.  $\text{C}_2\text{H}_5\text{NO}_2$  (nitrite of ethyl—nitrous ether). The various arti-

ficial fruit essences, pine-apple, pear, &c., are nothing but different species of compound ethers. Thus we see that *ethers proper* correspond, in organic chemistry, to basic anhydrides or metallic

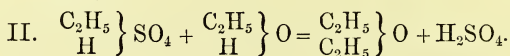
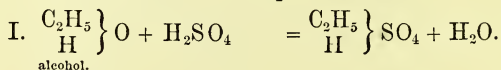
oxides, e. g.  $\left. \begin{smallmatrix} \text{K} \\ \text{K} \end{smallmatrix} \right\} \text{O}$ ; *simple ethers* to haloid salts, e. g.  $\text{KCl}$ ;

and *compound ethers* to oxysalts, e. g.  $\text{KNO}_2$ ,  $\text{AgNO}_3$ , &c. The only difference is, in the one case, we have metallic radicals, and in the other, alcohol-radicals.

*Preparation.*—The process for the preparation of ether embraces two stages, 1°, its generation, and 2°, its purification.

The ether is derived solely from the action of sulphuric acid on alcohol, the chloride of calcium and slaked lime used in the process are provided for its subsequent rectification.

Two distinct steps are involved in the action of the acid on the alcohol. An acid ether (ethyl-sulphuric or sulphovinic acid) is first formed and then immediately decomposed in presence of more alcohol into free ether and sulphuric acid.



preparation and to distinguish it from analogous products obtained from alcohol by other acids than sulphuric. The formula of true sulphuric ether,

i. e. sulphate of ethyl, is  $\left. \begin{smallmatrix} \text{C}_2\text{H}_5 \\ \text{C}_2\text{H}_5 \end{smallmatrix} \right\} \text{SO}_4$ , analogous to that of sulphate of potassium,  $\left. \begin{smallmatrix} \text{K} \\ \text{K} \end{smallmatrix} \right\} \text{SO}_4$ . It is believed to exist in "heavy oil of wine."

As fast as the sulphuric acid is liberated it again reacts on the alcohol, and the acid finally remains in the retort as ethyl-sulphuric acid. It would appear, then, that a small quantity of sulphuric acid should etherify an almost indefinite quantity of alcohol, but the operation is ultimately limited by the occurrence of secondary reactions and by the acid becoming too much diluted by the water set free in the first step of the decomposition. Part of this water distils over with the ether. Many other compounds besides sulphuric acid are capable of etherifying alcohol.

Since fresh spirit is directed to be supplied "in a continuous stream as soon as the ethereal fluid begins to pass over," this procedure is termed the *continuous etherification* process of Boullay. The alcohol is added gradually, as otherwise a considerable portion of it would distil over undecomposed. The temperature must not be allowed to rise too high, or secondary products will be obtained. The temperature most favourable to the formation of ether is from  $284^{\circ}$ - $290^{\circ}$ .

*Purification.*—In the above process sulphurous acid is usually formed by the deoxidation of sulphuric acid, while water and unchanged alcohol also come over. To remove these impurities the crude ether is agitated with slaked lime and a saturated solution of chloride of calcium, and redistilled. The lime absorbs the sulphurous acid, and any trace of sulphuric acid that may have come over, sulphite and sulphate of lime being formed, and it will also decompose any "heavy oil of wine" that may have been developed. The calcic chloride retains the water, part of the alcohol, and also a little of the ether. The rectified ether then consists of 92% by volume of pure ether and 8% of alcohol, which it still retains.

*Characters and Tests.*—Ether is extremely volatile and inflammable, and burns with a luminous flame; hence it must be kept in accurately stoppered bottles, in a cool place, and it should never be poured out near a candle or other source of flame.

Dangerous and even fatal accidents have resulted from neglect of this precaution. Moreover its vapour when diffused through the air constitutes an explosive mixture. Ordinary ether boils at or near  $105^{\circ}$ , but, when perfectly pure, it boils at  $95^{\circ}$ , and forms a very heavy vapour. At a very low temperature ether crystallises in brilliant white plates. If the sp. gr. be above 0.735, too much alcohol or water is present. Ether and water are to some extent soluble in each other, and when agitated with an equal volume of water, the diminution of volume should not exceed 10%, otherwise an excess of water or alcohol would also be indicated. One part of ether dissolves in 8–10 parts of water, i. e. a pint of water will take up about 2 oz. of ether, while 36 parts of ether take up 1 of water.

Should it contain any oily liquid, such as *heavy oil of wine*, the ether will become milky when diluted with water. When long kept it undergoes decomposition, and some acetic acid is formed, and a little ozone is developed, but, when recent, it should not redden litmus, and when evaporated should leave no residue, nor give out any unpleasant odour.

*In Pharmacy.*—Ether has very extensive solvent powers, especially over resins, fats, and oils (fixed and volatile), i. e. over bodies which contain a large proportion of carbon and hydrogen.

Thus it is prescribed as a test of the purity of kamala, of scammony and its resin, of resin of podophyllum, &c. A mixture of 3 parts ether and 1 part rectified spirit dissolves pyroxylin (gun-cotton) and forms collodion. Ether is also a good solvent of cantharidin, and accordingly it is used for that purpose in *Liquor Epispasticus*.

Ether unites in all proportions with alcohol, and the *Spiritus Ætheris* is a mixture of common ether with twice its bulk of rectified spirit, and is readily miscible with water.\* Ether which

\* The preparation commonly known as “Hoffmann’s anodyne liquor” is a spirit of ether containing, in addition, some heavy oil of wine (ethereal oil). Its uses are similar to those of ether, but it may be regarded as more decidedly antispasmodic.



contains a little water forms a soluble compound with tannin, (which is almost insoluble in pure ether), and the preparation of Acidum Tannicum is based upon this property. Iodine, sulphur, and phosphorus are dissolved by ether. Ether enters into the preparation of four of the extracts. In two of them, viz., ergot and stramonium, it is employed for the purpose of removing fixed oil in the commencement of the process; but in the two others, viz., fern and mezereon, it is utilised as the actual solvent of the oily active principle of the drug.

It also dissolves mercuric iodide and chloride, and is often used to detect the presence of these poisonous salts in samples of mercurous iodide and chloride, which, when pure, are insoluble in ether.

*In Medicine.*—Ether is administered by the stomach, or through the air-passages, or it is applied locally as an anæsthetic.\* The last named use is founded upon the extreme volatility of ether, and the consequent rapid absorption of heat during its vaporisation. The cooling power of ether can well be shown by a simple experiment. If a small thin glass tube containing water and enveloped in cloth be dipped a few times in ether, allowing the ether to evaporate after each immersion, the water may be frozen. The “ether-spray,” as it is termed, is directed on any required part by a suitable apparatus, and the intense cold produced rapidly brings about local anæsthesia. For this purpose the ether must be anhydrous and perfectly pure. This mode of application was introduced by Dr. B. W. Richardson, of London, and has borne good fruit in numerous minor surgical operations. It has even been used in capital operations. A good deal of pain sometimes attends the rapid congelation of the tissues, and the skin becomes tough and difficult to cut. The local irritant effects of ether are much less marked than those of chloroform.

\* This term was proposed by Dr. O. W. Holmes in 1846.



The topical refrigerant effect of ether thus applied is sometimes directed with immediate advantage to the reduction of strangulated hernia, and the evaporation of a little ether from the forehead or scalp will sometimes remove headache, while a few drops introduced into the ear will often arrest earache.

*Internally.*—Ether acts as a powerful diffusible stimulant and is very valuable as an antispasmodic. Its stimulant action is active and penetrating, but transient. It is frequently added to expectorant mixtures, and is often prescribed with benefit in low fevers attended with subsultus tendinum, in anæmic nervous headaches, hysterical paroxysms, nausea and flatulent colic, and may often be suitably conjoined with laudanum. It frequently affords signal relief in hiccup, nervous asthma, and angina pectoris. The average dose is about 30 minims, but when habitually used, a much larger dose will be required.

Trousseau took as much as 6 grm. (about  $3\text{ii}\frac{1}{4}$ ) at one time. It may be administered in the form of Spiritus Ætheris, or in capsules; and it is stated that it may be perfectly incorporated with water by first rubbing it up with spermaceti (2 grs. to 3j.) Ether, when added to cod-liver oil, assists its digestion and renders it tolerable in some cases where it could not otherwise be taken. It is so given on the theory of its increasing the pancreatic secretion and so favouring the assimilation of fats.

*Etherisation*, or the inhalation of ether, is extensively used, especially in America, for the purpose of inducing general anæsthesia during surgical operations. To Dr. W. Morton, at the instigation of Dr. C. Jackson, belongs the credit of introducing this practice in 1846. The first anæsthetic operation under ether occurred at Boston on September 30th, 1846. The vapour of the ether may be conveniently inhaled through a soft sponge or handkerchief applied over the nostrils and saturated with pure ether. Irritation of the throat with coughing is usually the first evidence of its action. This is quickly followed

by signs of general stimulation and exhilaration, which soon pass into the stage of unconsciousness and anæsthesia. Unpleasant after-effects rarely follow its administration. In from two to five minutes the patient becomes insensible, as much as  $\bar{3}$  ij. of ether being often required, but the time involved varies considerably. Sometimes the patient retains consciousness while insensible to pain. Sickness of stomach is incidental to its use as well as to that of chloroform. Etherisation causes complete muscular relaxation, even more so, it is stated, than chloroform, but it produces much more excitement. Ether is not so apt as chloroform to depress the heart's action, and is therefore a safer agent, and death has very rarely resulted from its use; but chloroform possesses certain advantages which account for the more extended favour accorded to it in Europe. In all cases probably careful attention to the respiration will obviate any danger that may arise under the use of ether. (See Chloroform.) It has lately been shown by Mr. Harry N. Draper and others, that in the north of Ireland, viz., Antrim, Londonderry, and Tyrone, the inhabitants are in the habit of drinking methylated ether for the sake of its intoxicating effects. The custom crept in as a substitute for whiskey-drinking; and from  $\bar{3}$  ij. -  $\bar{3}$  iv. are swallowed at a time. Habit lessens the influence of ether, and Christison mentions that he has known  $\bar{3}$  ij. of ether to be taken daily for several years without apparent injury, and a pint a day has been taken for the relief of pain in scirrhus of the colon.

### ÆTHER PURUS.

Ether, as prepared by the foregoing process, still retains about 8% of alcohol. This residual alcohol is removed by agitating the ether twice with water. The alcohol and water combine together and subside, leaving the ether floating on the top. The supernatant ether is decanted, and in order to free it from any water which it took up in the process of washing it is allowed to

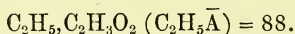
stand for twenty-four hours over chloride of calcium, and a little quicklime, and redistilled at a gentle heat. The whole of the water and any trace of spirit are retained by the lime compounds, and pure anhydrous ether distils over.

*Characters and Tests.*—Pure ether should have a sp. gr. of 0·720, and should boil at 95°–98°. It is not frozen by a cold of 146° below zero.

*In Pharmacy.*—Pure ether is employed in the preparation of Aconitia and Digitalin; in the test-analysis of Cinchona Flava; and in the determination of quinia in Ferri et Quiniæ Citras. Although it dissolves most of the vegetable alkaloids it does not dissolve potash or soda, and in this respect differs from alcohol.

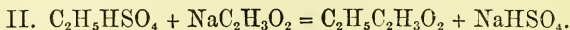
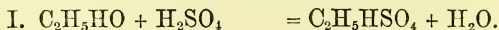
*In Medicine.*—Used as a local anæsthetic.

### ÆTHER ACETICUS.



*Preparation.*—Distil a mixture of dry (i. e. anhydrous) sodic acetate, rectified spirit, and sulphuric acid.

As in the case of ordinary ether two stages occur in the reaction.



The product is freed from water by digestion with half its weight of chloride of calcium, and, to remove free acetic acid which will always be present, it should be rectified over potassic carbonate.

*Characters and Tests.*—This, the first of the three officinal compound ethers, has a burning taste, and a grateful, fruity odour, resembling that of ripe apples. It keeps pretty well, is tolerably soluble in water, and is a good solvent for essential oils, resins, pyroxylin, and cantharidin. If completely soluble

in nine parts of water, the presence of alcohol is indicated. It is decomposed by alkalies, e. g. caustic potash, into potassic acetate and alcohol.

*In Pharmacy.*—Occurs in small quantity in the Tinct. Ferri (Per)acetatis, from mutual reaction of the spirit and acetic acid.

*In Medicine.*—Occasionally used as a stimulant and antispasmodic in fevers, cardialgia, and spasmodic affections of the stomach and alimentary canal. Dose, 3ss. sufficiently diluted with water. It has been proposed by Dr. Hor. Wood as an anæsthetic. A little of it added to brandy gives it the flavour of cognac.

### ALBUMEN OVI.

Albumen belongs to the class of the so-called Proteids, or albumenoid bodies, which includes casein, fibrin, globulin, and some closely allied substances.

These bodies are almost chemically identical in their percentage composition, i. e. contain nearly the same amounts of C, H, N, and O, but their exact constitution is not known, and no reliable formula can be offered.

They are all uncrystallisable, contain sulphur, and are readily decomposed on exposure to the air. Egg albumen is coagulated by ether, serum albumen is not.

Albumen forms 12% of the white of egg; it is coagulated by heat at temperatures above  $140^{\circ}$ , and is then no longer soluble in water. The cause of this coagulation has not been ascertained. If much alkali be present the solution does not coagulate when heated.

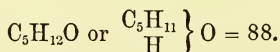
*In Pharmacy.*—The sole use of albumen in the Pharmacopœia is to furnish a solution of albumen (App. II.), one "white" to 4 oz. of water, which is used as a test for metaphosphoric acid,  $\text{HPO}_3$ , in Acid Phosph. Dil. The former acid coagulates albumen; the latter does not. Other mineral acids,

e. g. sulphuric, nitric, and muriatic, also precipitate albumen, but, of the varieties of phosphoric acid, metaphosphoric alone possesses this power, and, indeed, it and acetic acid redissolve albumen when coagulated. Gallo-tannic acid (tannin of galls) stands alone among the organic acids in coagulating albumen. The white, or still better the yolk of egg, is well adapted for emulsifying oils and resins.

*In Medicine.*—Albumen is particularly recommended as a temporary antidote in cases of poisoning by salts of mercury and copper, as it forms insoluble compounds with these as also with many other metallic salts.

### ALCOHOL AMYLICUM.\*

*Synonym.* FOUSSEL† OIL.

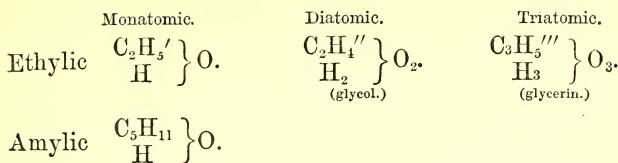


The term *alcohol* although originally restricted to the volatile spirituous liquid obtained by the fermentation of sugar is now made a generic term and embraces a considerable number of bodies which possess chemical properties *analogous* to those of ordinary or ethylic alcohol, whether they be solid or liquid.

Alcohols are classified into monatomic, diatomic, triatomic, &c. according as they are constructed on the type of one molecule of water,  $\left. \begin{array}{c} \text{H} \\ \text{H} \end{array} \right\} \text{O}$ ; two,  $\left. \begin{array}{c} \text{H}_2 \\ \text{H}_2 \end{array} \right\} \text{O}_2$ ; three,  $\left. \begin{array}{c} \text{H}_3 \\ \text{H}_3 \end{array} \right\} \text{O}_3$ , &c., by the replacement of *half* the hydrogen by the equivalent alcohol radical. Or, it may be otherwise expressed, according as they contain one, two or three atoms of replaceable or typical hydrogen. Now we have two examples of monatomic alcohols, and one instance of a triatomic alcohol in the Pharmacopœia, and the relationship of their formulæ is as follows. No diatomic alcohol (glycol) is used in medicine.

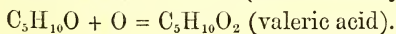
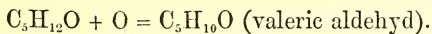
\* *Amylum*, starch.

† Φύω, to produce.



*Preparation.*—Amylie alcohol (grain oil, or potato oil) is always found, mixed with ordinary ethylie alcohol and certain other alcohols, in spirit obtained from starch sugar, and is most abundant in that procured from fermented potatoes. It is separated by continuing the distillation of the crude spirit at a temperature of  $270^\circ$ , the boiling point of amylie alcohol, when the fousel oil will come over nearly pure.

*Characters and Tests.*—Strictly speaking fousel oil and amylie alcohol are not true synonyms, because fousel oil varies considerably in character according to the source from which it has been procured, and it often includes more or less of other alcohols, e. g. butylie,  $\text{C}_4\text{H}_{10}\text{O}$ . As usually prepared it has a pale yellowish colour. The odour, which is very heavy and offensive, is characteristic, and the presence of fousel oil as an impurity frequently communicates a peculiar disagreeable odour and acrid taste to whiskies and brandies. Its vapour is irritating when respired, and it burns difficultly with a blueish flame. It dissolves iodine, sulphur, and phosphorus, and is also a good solvent for fats, resins, and camphor. When dropped upon paper it does not leave a greasy stain. Like the other alcohols, fousel oil is readily oxidised, and is converted, first, into valeric aldehyd, and finally into valerianic (valeric) acid. The oxidation may be effected slowly by the condensed oxygen included in platinum-black, but more quickly by sulphuric acid and bichromate of potassium.





Valeric acid bears the same relation to amylic alcohol that acetic acid does to ordinary alcohol.

*In Pharmacy.*—The only applications made of fousel oil are in the preparation of valerianic acid (see Sodæ Valerianas), for which purpose it was introduced into the Dublin Pharmacopœia of 1850, and of nitrite of amyl.

## ALÖE\* BARBADENSIS.

### ALÖE SOCOTRINA.

*Origin.*—The two officinal varieties of aloes are named geographically—the Barbadoes aloes from its place of importation, although the plant is a native of Europe and N. Africa; and the Socotrine, from its native country, the island of Socotra near the mouth of the Arabian gulf. The exact species of Aloe, N. O. Liliaceæ, which furnish the commercial drug are uncertain, but those commonly accepted are Aloe vulgaris, A. Socotrina, and A. spicata. The purgative juice is contained in channels towards the outer surface of the leaves, which are remarkable for their fleshy thickness and horny-toothed margins. True Socotrine aloes is almost unknown at this date in commerce. From the Returns of the Board of Trade for 1866, it appears that  $\frac{1}{8}$  of the imported aloes was of the orthodox sorts, at about 1s. 6d. per pound; while Cape aloes contributed  $\frac{7}{8}$  of the whole, at the prime value of  $3\frac{1}{4}$ d. per pound.

*Preparation.*—The finest aloes is that which exudes spontaneously from the incised leaves, and is subsequently inspissated in the sun, but more commonly artificial heat is employed. An elevated temperature acts injuriously by converting some of the soluble active principle into an insoluble and inert substance, and also decomposes the aloin.

*Characters.*—The chief points of contrast between the charac-

\* Hebrew, *Ahlah*, growing near the sea.



ters of the kinds of aloes will be best understood by a reference to the accompanying table—

BARBADOES.	SOCOTRINE.
Dark brown, or nearly black.	Reddish brown.
Opaque even in thin layers.	Usually translucent at the edges.
Fracture dull and conchoidal.	Fracture smooth and sharp.
Odour strong and disagreeable.	Odour strong but fragrant.
Almost entirely soluble in proof spirit.	Entirely soluble in proof spirit.
Powder dull olive yellow.	Powder bright golden yellow.
Usually imported in gourds ( <i>Lagenaria vulgaris</i> ).	Imported in skins or chests.

Barbadoes aloes is more soluble in water than Socotrine.

The odour is best brought out by breathing upon the drug. The nauseous bitter taste of aloes is proverbial, and has been so for 2000 years. The numerous microscopic crystals exhibited during solution of either kind of aloes in spirit are those of *aloin*, which constitutes from 50 to 80% of aloes.

*Aloin* ( $C_{34}H_{36}O_{14}H_2O$ ), first obtained by T. and H. Smith, seems to be a glucoside, for, when boiled with dilute acid, it yields glucose and aloesetic acid. Aloetic and aloeretic acids are also reckoned among the ingredients of aloes, but are possibly products of decomposition. Aloes resin is, possibly, nothing but modified aloin.

*In Pharmacy.*—The number of the preparations of aloes might, with great advantage, be materially lessened, and it cannot signify much which kind of aloes is employed. The solubility of aloes in water is illustrated by the extracts and decoction; and in spirit by the tincture and wine. Carbonate of potassium is added to the Dec. Aloes Co. to assist in the solution of the resinoid principles of aloes.

*In Medicine.*—Aloes is a certain, but slow, stimulating cath-

artic, and directs its action chiefly to the large intestine. Although it may provoke a bilious stool it is in no wise a hydragogue purgative. It may be considered to hold an intermediate position between rhubarb and senna. Its asserted tendency to irritate the rectum and induce congestion of that viscus is questioned by some: but its specific influence is exhibited when it is applied externally to a blistered or wounded surface as when it is administered by the ordinary channel. It is contraindicated in any irritation of the pelvic organs and in pregnancy. In many cases, however, it is quite possible that the causation of piles with which aloes is so often discredited is due to the constipation which the drug is employed to remove, and not to the medicine itself. A peculiarity in its action, in which it coincides with calomel, is, that an increase in the quantity administered over and above an average dose is not attended by a corresponding increase of effect.

It is generally considered to possess especial virtues as an emmenagogue, and to its bitterness is probably owing its valuable combination of effects as a tonic-aperient.

The dose of aloes as given in the Pharmacopœia is from 2 to 6 grs., but in many if not in all cases, much smaller doses will answer best, and  $\frac{1}{4}$  to  $\frac{1}{3}$  gr. of the extract given every hour or two will often purge where large doses of cathartics have proved ineffectual.

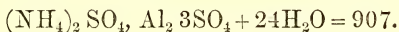
Small doses of aloes are long in repute as a gentle aperient and stomachic in chronic dyspeptic constipation, and form an important ingredient in most of the so-called "dinner pills." No better treatment, so far as drugs go, can be adopted in cases of simple constipation from torpidity than minute and frequent doses of extract of aloes, not exceeding 1 gr., combined with 1 to 2 grs. of dried sulphate of iron. As the intestinal functions are restored the number and frequency of the pills should be reduced, and nothing approaching to purgation ought ever to be

attempted. As a fluid substitute in certain cases, Mist. Ferri Co., with Dec. Aloes Co., in corresponding doses, may be adopted.

On account of its bitter nauseous taste aloes is best administered in pill, and, moreover, the solid form is the more efficacious, for it is found that twice or thrice the quantity in solution is required to produce the same effect. The aqueous extract is the best preparation, because aloes yields the whole of its active matter to water. Aloes is more frequently given in combination with other drugs than singly, and its union with green vitriol (Pil. Aloes et Ferri) seems to increase the aperient action of the aloes and at the same time to lessen its tendency to irritate the rectum. The addition of sulphate of quinia or of ipecacuanha is said to have the same effect.

Aloin has occasionally been ordered in doses of gr. ss. to gr. ij. in pill.

### ALUMEN\*.



Common or ammonia alum (sometimes incorrectly termed sulphate of alum) is the only officinal representative of the class of chemical bodies termed *alums*.

An alum may be defined to be a neutral double sulphate with 24 molecules of water of crystallisation. One of the metals is always an alkaline metal, i. e. K, Na, or  $\text{NH}_4$ ; and the other metal is either Fe, Cr, Mn, or Al. The formula given above is double that indicated in the Pharmacopœia, and is in accordance with the usual view as to its constitution.

Ammonia alum on account of its greater cheapness, has almost excluded the potash alum from the market.

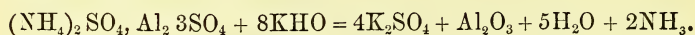
Every alum crystallises in regular eight-sided figures, or octahedra. Cubic crystals can also be obtained.

\* Arabic, *Alum*; or, *âlag*, a salt.

*Preparation.*—Ordinary alum is obtained by exposing aluminous slate, including sulphur, to the air.

Sulphate of aluminum is formed by oxidation, is dissolved out by water, and, on the addition of sulphate of ammonium, yields on concentration crystals of alum.

*Characters and Tests.*—Alum is usually met with in lumps or masses from which project numerous crystals exhibiting the characteristic octahedral faces. The officinal variety is colourless, but chrome alum is dark reddish-brown. Alum dissolves in about 18 parts of cold water, and in three-fourths of its weight of boiling water. It is insoluble in alcohol. Sp. gr. 1·71. It reddens blue litmus, but changes blue tinctures to green. When ammonia alum is calcined pure alumina ( $\text{Al}_2\text{O}_3$ ) is left behind. Alumina is an oxide insoluble in water, hence, on adding a soluble base such as potash or soda to a solution of alum the alumina is precipitated, provided too much alkali be not added, as it is soluble in an excess of fixed alkali. At the same time, the volatile alkali ammonia is expelled by the more fixed base, potash or soda.



By this latter test a potassic alum is readily known from an ammoniac alum. Like every soluble sulphate, alum gives an immediate dense precipitate of baric sulphate with chloride of barium, and should it contain any trace of persalt or protosalt of iron it will give a blue colour with the yellow or red prussiate of potash respectively.

*In Medicine.*—Alum is principally used as an astringent, but in large doses it is emetic. With albumen, casein, and gelatin, it forms insoluble compounds, which, however, are soluble in acids, and from which the alum is not precipitated by alkalies. Since the vegetable astringents (i. e. tannin) decompose alum and probably diminish its astringent properties, the association of such drugs as alum and Decoct. Cinchonæ, or Dec. Quercus should be avoided.

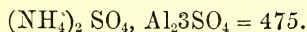
Notwithstanding its local irritant and astringent action it has been shown that alum is absorbed into the system.

*Internally* it is frequently given with great benefit in passive hemorrhages, obstinate perspiration, bronchorrhœa, and in chronic diarrhœa and dysentery, in 10 gr. doses. As a remedy in painters' colic it was introduced more than a hundred years ago, and, conjoined with opium, it mitigates pain, relieves flatulence, and acts generally with certainty as an aperient. It may be administered as alum whey,  $\zeta\text{ij}$ . to a pint of milk. Full doses of alum, i. e.  $\zeta\text{i}$ . every ten or fifteen minutes until vomiting is induced, have been strongly recommended as an excellent emetic in catarrhal laryngitis and other affections. It is a safe, non-prostrating emetic.

*Locally* it is well adapted for astringent washes and lotions, and finds many applications in the treatment of relaxed sore throat, gonorrhœa and gleet, in epistaxis, and as a collyrium in conjunctivitis and purulent ophthalmia of children. A lump of alum moistened and pressed against piles when they protrude during defecation is a convenient and effectual mode of constringing the dilated vessels. The topical application of the powder of alum, by insufflation, is sometimes to be preferred in cases of chronic sore throat, or in bleeding from the nose. A poultice made by adding  $\zeta\text{i}$ . of alum to the whites of two eggs is an appropriate and grateful form of applying it to the eye.

Alum is extensively used to adulterate bread, and its detection under such circumstances is often a matter of some difficulty.

## ALUMEN EXSICCATUM.



When alum is moderately heated the water of crystallisation is liberated with much frothing, the salt dissolves in this water, and is said to undergo "aqueous fusion." But, on continuing

the heat, all the water is driven off, and an amorphous porous residue of *burnt alum* is left. The water of crystallisation constitutes 47·6% of the weight of the salt, as appears from the formula.

If the temperature be allowed to rise beyond 400°, the ammonia and sulphuric acid will be expelled and pure alumina ( $\text{Al}_2\text{O}_3$ ) will remain. Since dried alum rapidly reabsorbs water from the atmosphere it is directed to be preserved in a well-stopped bottle.

Burnt alum is occasionally used as a mild caustic, but its retention in the Pharmacopœia seems superfluous.

### AMMONIACUM.\*

*Origin.*—This drug is a gum-resin derived from *Dorema Ammoniacum*, N. O. Umbelliferae, and is a native of Persia and the N. W. of India. It either exudes from the stem or leaves as a milky juice on the slightest puncture, or is the product of incisions into the root. It is sometimes incorrectly termed “gum ammoniac.”

It is worthy of remark that not only are the other fetid gum-resins, *Assafoetida* and *Galbanum*, derived from the same Natural Order, but they come from the same region of the world, viz., Persia, Affghanistan, and the North of India, and it has been observed that some of these plants are constantly found growing near each other, e. g. *assafoetida* beside the *ammoniacum* plant.

*General Characters of Gum-Resins.*—This being the first member we meet of the natural group of gum-resins, it will be well to state here, once for all, the general characters of these bodies.

\* *Ἀμμος*, sand, from its habitat; or, because it grew near the temple of Jupiter Ammon in Libya. Others believe that the name ammoniacum, or armoniacum as it was often written, is a corruption of Armeniacum, because the plant is a native of Armenia.



Gum-Resins are vegetable products which consist, as their name imports, of gum + resin, the latter usually forming much the larger proportion. In colour they vary from orange-yellow to brown and greyish-black, and, when fresh, are generally soft enough to be indented by the nail. From their nature they are but partially soluble in water; when rubbed up with it the gum alone dissolves, and the resin being merely suspended in fine powder through the mucilage gives the fluid a turbid, milky character, or, in other words, an *emulsion* is produced.

This character distinguishes gum-resins from resins. Conversely, alcohol is only a partial solvent because gum is not soluble in that menstruum. The officinal gum-resins are Ammoniacum, Assafoetida, Galbanum, Gamboge, Myrrh, and Scammony, and each, except Gamboge, possesses an odour peculiar to itself. Therapeutically, all of them are stimulant and usually antispasmodic in their action, and some of them when given in full doses are active purges. The relative percentage proportions of gum and resin in the six officinal gum-resins are exhibited in the following Table :—

	RESIN.	GUM.	REMARKS.
Ammoniacum	70 — 72	18 — 22	Assafoetida and Scammony are obtained from the living root by incision. Myrrh contains by far the largest proportion of gum.
Assafoetida	48 — 65	19	
Cambogia	80 — 89	10 — 19	
Galbanum	66	19	
Myrrha	34 — 44	40 — 66	
Scammonium	77 — 81	3 — 6	

*Characters of Ammoniacum.*—Ammoniac occurs in commerce under two forms, viz., detached tears and large masses, but the former is preferable on account of its greater purity. It softens by heat and at a red heat burns with a white flame; sp. gr. 1.2. From its tendency to soften it cannot be readily pulverised except in cold weather. Rubbed up with camphor it is said that a mass is at once produced suitable for pills. The odour is

very peculiar and is best brought out in the emulsion. The volatile oil, unlike oil of assafœtida, does not contain sulphur.

*In Pharmacy.*—The Mistura Ammoniaci is a simple aqueous emulsion. It bears a strong resemblance to dirty milk, but becomes clear on standing.

*In Medicine.*—Ammoniacum is chiefly employed as a stimulating expectorant; and the Mistura furnishes an eligible basis for administration in chronic pectoral complaints, especially those attended with copious bronchial secretion. The Pil. Scillæ Co. is also a useful combination for this purpose, or the Pil. Ipecac. c. Scilla.

Externally it enjoys some reputation as a stimulating application in chronic indolent swellings of the joints and lymphatic glands, inflamed bursæ, e. g. housemaid's knee, but the Empl. Ammon. c. Hydr. is liable to cause local irritation of the skin, and the mercury which it contains sometimes affects the gums.

### AMMONIUM.\*

Ammonia gas,  $\text{NH}_3 = 17$ ; Ammonium,  $\text{NH}_4 = 18$ .

Hydrate of Ammonium,  $\text{NH}_4\text{HO} = 35$ .

#### TABLE OF THE COMPOUNDS AND PREPARATIONS OF AMMONIUM IN THE PHARMACOPŒIA.

The *solid* preparations of ammonium appear in the Pharmacopœia under their appropriate chemical names, e. g. Ammonii Chloridum; the *liquid* preparations are ranged under other heads, e. g. Liquor Ammonia.

Those marked (a) occur only in the Appendix, and are used as tests. All the officinal preparations will be described alphabetically.

\* In order to avoid repetition, a brief sketch of the general characters of the ammonium preparations will be first given, and then all the officinal compounds will be conveniently described alphabetically.

## I.—CONTAINING FREE AMMONIA.

- |                          |                                       |
|--------------------------|---------------------------------------|
| 1. Ammoniaë Liq. Fortior | $\text{NH}_3$ , 32·5%. sp. gr. 0·891. |
| „ Liquor.                | do. 10%. do. 0·959.                   |

## II.—HALOID SALTS.

- |                     |                             |
|---------------------|-----------------------------|
| 2. Ammonii Bromidum | $\text{NH}_4\text{Br}$ .    |
| 3. „ Chloridum      | $\text{NH}_4\text{Cl}$ .    |
| 4. „ Sulphidum (a)  | $(\text{NH}_4)_2\text{S}$ . |

## III.—OXYALS.

*a. Monobasic.*

- |                             |   |
|-----------------------------|---|
| 5. Ammoniaë Acetatis Liquor | $\text{NH}_4\text{C}_2\text{H}_3\text{O}_2(\text{NH}_4\bar{\text{A}})$ .  |
| 6. „ Benzoas                | $\text{NH}_4\text{C}_7\text{H}_5\text{O}_2(\text{NH}_4\bar{\text{Bz}})$ . |
| 7. „ Nitras                 | $\text{NH}_4\text{NO}_3$ .  |

*β. Dibasic.*

- |                      |   |
|----------------------|---|
| 8. Ammoniaë Carbonas | $[2(\text{NH}_4\text{HCO}_3), \text{NH}_4\text{NH}_2\text{CO}_2]$ .           |
| 9. „ Oxalas (a)      | $(\text{NH}_4)_2\text{C}_2\text{O}_4 \cdot [(\text{NH}_4)_2\bar{\text{O}}]$ . |

*γ. Tribasic.*

- |                              |  |
|------------------------------|--|
| 10. Ammoniaë Citratis Liquor | $(\text{NH}_4)_3\text{C}_6\text{H}_5\text{O}_7 \cdot [(\text{NH}_4)_3\bar{\text{Ci}}]$ . |
| 11. „ Phosphas               | $(\text{NH}_4)_2\text{HPO}_4$ .  |

All the officinal ammoniacal salts are colourless.

*Origin.*—Ammonia exists in minute quantity in the atmosphere, probably as carbonate, and fulfils an important part as the main supply of nitrogenous food to vegetation, but the source of nearly all the ammonium salts is “gas liquor,” obtained in the distillation of coal for the manufacture of ordinary illuminating gas. This gas liquor contains a quantity of ammoniacal compounds, chiefly in the form of carbonate. When neutralised by hydrochloric acid, it yields sal-ammoniac ( $\text{NH}_4\text{Cl}$ ), and from this latter salt, when purified, are derived all the other ammonium compounds used in medicine.



*Chemical Relations.*—The compounds of ammonia are strikingly analogous, in their chemical relationships, to the potassium and sodium salts, and, as the basis of these latter substances is undoubtedly a metal, so it is believed that there is a metal, ammonium, as the fundamental radical of the ammonic series. But, while potassium and sodium (K, Na) are elementary bodies, ammonium is a compound body, or radical ( $\text{NH}_4$ ), acting like a simple body, and, until its recent isolation as a blue liquid, its existence was inferred rather than demonstrated.

Ammonium (sometimes represented by the symbol *Am*), is a univalent or monatomic group, i. e. it replaces one atom of H, and so corresponds with the other alkaline metals. Thus caustic potash is  $\left. \begin{smallmatrix} \text{K} \\ \text{H} \end{smallmatrix} \right\} \text{O}$ , and caustic ammonia is  $\left. \begin{smallmatrix} \text{NH}_4 \\ \text{H} \end{smallmatrix} \right\} \text{O}$ . The term *ammonia* is applied both to the free gas  $\text{NH}_3$ , i. e. ammonic anhydride, and also to the solution of this gas in water, when it forms hydrate of ammonium, thus  $\text{NH}_3 + \text{H}_2\text{O} = \left. \begin{smallmatrix} \text{NH}_4 \\ \text{H} \end{smallmatrix} \right\} \text{O}$ . In fact, ammonia gas,  $\text{NH}_3$ , does not, as a rule, enter into combination with another body until it has fixed an additional atom of H and is so converted into  $\text{NH}_4$ . But the hydrate of ammonium cannot be isolated by evaporation, because it is so unstable that it instantly splits up by heat into ammonia gas (i. e. its anhydride) and water.

The existence of *crystallisable* hydrates of ammonium bases which are known in organic chemistry lends important support to the ammonium theory.

*Test.*—The distinctive test for all ammoniacal compounds consists in the liberation of the pungent alkaline gas, ammonia, when any of them is heated with a fixed base, e. g. potash, soda, or lime. Thus,  $\text{NH}_4\text{Cl} + \text{KHO} = \text{KCl} + \text{H}_2\text{O} + \text{NH}_3$ .

The most delicate test for *minute quantities* of ammonia, e. g. in a drinking water, is Nessler's solution, i. e. an alkaline solution of double iodide of mercury and potassium ( $\text{HgI}_2$ , 2KI). The

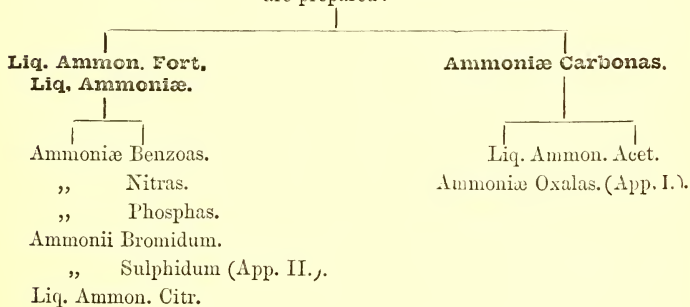
most minute quantity of ammonia or ammoniacal salt will give with this test-liquid, a yellow coloration; a larger quantity, a reddish-brown precipitate =  $\text{NH}_2\text{I}$ .

The quantitative estimation of free ammonia or its carbonate can be effected by neutralisation with the standard solution of oxalic acid.

### GENEALOGICAL TABLE OF THE AMMONIUM COMPOUNDS.

From **Ammonii Chloridum**,  $\text{NH}_4\text{Cl}$  (from gas liquor)

are prepared:—



*General Therapeutical Effects.*—The prevailing physiological action of ammonia and its salts is stimulant, externally or internally.

As therapeutic agents they are used chiefly (*a*) as antacids, e. g. Liq. Ammonia and Ammon. Carb.; (*b*) stimulants and antispasmodics, e. g. ammonia and its carbonate and acetate; (*c*) as diuretics and diaphoretics, e. g. Liq. Ammon. Acet.; (*d*) as external irritants, e. g. Liq. Ammon. Fort.; and Liq. Ammonia.

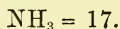
Compared with other stimulants, such as camphor, wine, and opium, ammonia acts more on the ganglionic and spinal

nervous systems than on the cerebral, is more transient in its effects, and promotes instead of diminishing mucous secretion.

In organic chemistry, it is to be remarked that while the most diverse salts of the primary, secondary, and tertiary amines (ammonia-bases) are comparable in their physiological effects to other ammoniacal compounds, and, according to M. Rabuteau, are muscular poisons in large doses, the salts of the organic ammonium-bases appear to be poisons of the motor nerves completely analogous in their effects to those of curara.

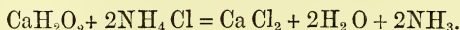
### AMMONIÆ LIQUOR.

#### AMMONIÆ LIQUOR FORTIOR.



Aqueous solutions of ammonia gas, the first being about  $\frac{1}{3}$  the strength of the second. Solutions of ammonia are popularly termed *hartshorn*, or, *spirits of hartshorn*.

*Preparation.*—Ammonia gas, the volatile alkali, is obtained, by heating sal-ammoniac ( $\text{NH}_4\text{Cl}$ ) with the fixed base, slaked lime—



The gas is conducted into water, which absorbs more than 500 times its bulk of ammonia, and, at the same time, increases considerably in bulk. One part of the strong solution mixed with two parts of distilled water constitutes the “Liquor Ammoniae.”

*Characters and Tests.*—*Liquor Ammoniae Fortior.*—The odour of ammonia is very characteristic and is sufficiently familiar; inadvertent inhalation of the strong solution causes great irritation of the eyes and air passages. The solution turns reddened litmus blue, yellow turmeric brown, and red cabbage green. With the vapour of any volatile acid, especially  $\text{HCl}$  or  $\text{HNO}_3$ ,



it forms white fumes. The sp. gr. of the strong solution should be 0·891, but usually ranges above 0·900 because some of the ammonia readily escapes. The amount of ammonia in the solution is estimated by ascertaining how much of the standard solution of oxalic acid is required to neutralise a given weight of it. The purity tests are (*a*) lime water, for carbonic acid gas, which the solution absorbs from the air; (*b*) oxalate of ammonia, for lime; (*c*) sulphide of ammonium, for heavy metals, e. g. lead or copper; (*d*) ammonio-sulphate of copper for sulphuretted hydrogen; and, in the acidified solution, (*e*) nitrate of silver, for chlorides; and (*f*) chloride of barium, for sulphates. The properties of *Liquor Ammoniæ* are, of course, similar to these but weaker in degree, and the same tests may be applied to it.

*In Pharmacy.*—*Liquor Ammoniæ Fortior* is used in the preparation of phosphate and citrate of ammonia, of Spir. Amm. Arom. (sal volatile), of compound camphor liniment, and Tinct. Opii Amm. (Scotch pargoric). *Liquor Ammoniæ* is used in the preparation of benzoate and of liniment of ammonia (volatile liniment). In the latter case the ammonia saponifies the olive oil. It is also employed in the preparation of several of the alkaloids, of the double salts of iron, of ammonio-citrate of bismuth, and of the *Injectio Morphine Hypodermica*.

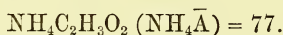
*In Medicine.*—*Liquor Ammoniæ Fortior*. Not exhibited internally in the undiluted state. Externally it is a powerful stimulant and vesicant, and even caustic, and is suitable in cases where a speedy counter-irritation is indicated, or where cantharides is inadvisable. It is best applied on a small piece of lint saturated with the liquid, and retained *in situ* by the lid of a pill-box, or by a watch-glass. A few minutes usually suffice for vesication. It has been especially employed in rheumatic, gouty, and neuralgic affections, and the Linim. Camph. Co. offers a convenient form for applying stimulation to the skin of children and delicate persons.

*Liquor Ammoniaë.*—As an alkali, or antacid, it may be given in flatulence and pyrosis. For its stimulant effects it is employed in hysteria, syncope, and asphyxia; and, if inhaled through the nostrils, its application must not be carried too far lest dangerous and even fatal bronchitis be induced. It has been recommended as an antidote to prussic acid, and to the bites of rabid animals, as well as to the stings of bees, scorpions, &c. Professor Halford has proposed the injection of *Liquor Ammoniaë* into the veins in cases of snake poisoning, but the results do not justify the sanguine hopes held out at its introduction. Similar treatment has been used with success in the treatment of poisoning by aconite.

Externally, in the form of *Linimentum Ammoniaë*, it is employed as a rubefacient.

The dose for internal use is 10 – 30 minims, freely diluted.

### AMMONIÆ ACETATIS LIQUOR.



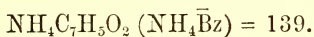
*Preparation.*—Acetic acid is gradually neutralised by commercial carbonate of ammonium, the carbonic acid gas escaping with effervescence.

*Characters and Tests.*—When pure and fresh it is a limpid, colourless, and odourless liquid, commonly known under the name of spirit of Mindererus. The original spirit of Minderer (introduced by Boerhaave in 1732), was prepared with distilled vinegar and spirit of hartshorn. Unless kept in well-closed bottles, it spoils by keeping, and should therefore be prepared in small quantities. The solution contains about 7% of acetate of ammonium, which, in the solid state, is a deliquescent salt with an acrid taste.

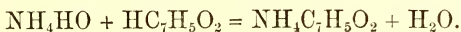
*In Medicine.*—Chiefly used as a diaphoretic and diuretic, either alone, or combined with nitre, camphor, or antimonials. In febrile and catarrhal complaints it often proves very grateful

and may be freely given in half-ounce doses. It also has the reputation of counteracting the effects of slight intoxication.

### AMMONIÆ BENZOAS.



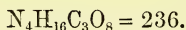
*Preparation.*—Benzoic acid is treated with slight excess of ammonia, and, on slow evaporation, crystals of benzoate of ammonia are deposited.



*Characters and Tests.*—The characteristic test for a benzoate is the formation of a reddish-yellow precipitate of ferric benzoate with persalts of iron. When heated with a fixed base, such as potash, it evolves ammonia gas; and if a soluble acid, e. g. HCl, be added to a strong solution of the salt, benzoic acid is deposited on account of its sparing solubility. Ammonic benzoate, even when gently heated, readily loses some of its ammonia and passes into an acid benzoate.

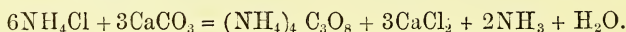
*In Medicine.*—It is esteemed a somewhat stimulant diuretic, and has been used in the treatment of phosphatic deposits in the urine, for it distinctly renders urine acid. It is also recommended in scarlatinal albuminuria, and is preferable to benzoic acid, on account of its greater solubility. In its passage through the system, the benzoic acid of the salt is converted into hippuric (glyco-benzoic) acid by combining with the elements of glycocin (sugar of gelatin), a substance which occurs in the bile. The urine is thus rendered acid, for the ammonia does not appear in that secretion. This conversion of benzoic into hippuric acid is stated not to occur in certain cases of jaundice, i. e. where there is deficiency of glycocin. 15 or 20 grs. may be given dissolved in water.

## AMMONIÆ CARBONAS.

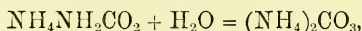


The real constitution of this complex formula is probably two molecules of acid (bi) carbonate of ammonium ( $\text{NH}_4\text{HCO}_3$ ) and one molecule of carbamate of ammonium ( $\text{NH}_4\text{NH}_2\text{CO}_2$ ).

*Preparation.*—Heat together a mixture of chalk with sal-ammoniac or sulphate of ammonium. The reaction may probably be explained as,



*Characters and Tests.*—When recent it is translucent, but, when long or insecurely kept, it gives off ammonia and carbonic acid gases, loses its odour, and crumbles down into an opaque friable mass of bicarbonate of ammonium. The commercial salt is readily soluble in four parts of cold water, but is decomposed by boiling water or by alcohol, and if a small amount of liquid be used, the carbamate alone will be dissolved out, leaving behind the bicarbonate. Since, in water, the carbamate soon changes into neutral carbonate:—



the aqueous solution of the ordinary salt will contain both neutral and acid carbonates of ammonium. Neutral carbonate of ammonium has not been isolated in the solid state.

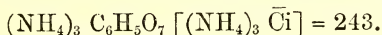
The presence of sulphate, or of chloride of ammonium, would be shown by the nitric acid solution (boiled to expel carbonic acid gas) giving a precipitate with chloride of barium, or nitrate of silver, respectively. Like other alkaline compounds, its purity is volumetrically estimated by the standard solution of oxalic acid (1000 gr. measures =  $\frac{1}{2}$  mol.  $\text{H}_2\text{C}_2\text{O}_4$ ), and, as the ammoniacal carbonate may be said to contain four molecules of ammonia, it follows that 59 grs. (i. e.  $\frac{1}{4}$  of its mol. wt.) should neutralise 1000 gr. measures of the oxalic acid solution.

*In Pharmacy.*—Solution of carbonate of ammonia (App. II.) is used as a test to precipitate insoluble carbonates. The acetate, and the aromatic spirit of ammonia are prepared from it, and the nitrate may be.

*In Medicine.*—This salt, besides possessing the antacid and powerful stimulating properties of ammonia, is emetic in large doses, but is seldom used for such purpose. In low forms of fever, typhus and scarlatina, for example, it is often of signal benefit. In gastric disturbance after a debauch, it has gained much credit, and it is one of the best remedies in the muscular debility which so often follows chronic rheumatism. The popular stimulant “smelling salts,” is formed by adding solution of ammonia to the commercial carbonate, aromatised with some essential oil; and the common remedy “sal volatile,” (Spir. Ammon. Arom.) is a spirituous solution of ammonia and neutral carbonate of ammonia flavoured with nutmeg and lemon. As a stimulating expectorant, the carbonate is much used in chronic bronchitis, and in the capillary bronchitis of children it gives valuable aid.

The ordinary dose is 5 grs. repeated every two, three, or four hours, and, if desired, it may be administered in effervescence, 20 grs. neutralising about 23 grs. of citric acid, and 25 grs. of tartaric acid.

### AMMONIÆ CITRATIS LIQUOR.



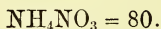
*Preparation.*—Neutralise a solution of citric acid with strong solution of ammonia.

*Characters.*—A colourless liquid, with a saline taste.

*In Pharmacy.*—Citrate of ammonia has the power, in common with the other alkaline citrates, of dissolving various metallic oxides, e. g. of iron, as in Ferri et Ammoniæ Citras.

*In Medicine.*—The solution is applicable to the same cases as the acetate, and is considered to be a more agreeable form for administration.

### AMMONIÆ NITRAS.



*Preparation.*—Saturate dilute nitric acid with ammonia or its carbonate, and evaporate the solution until crystals form.  
 $\text{HNO}_3 + \text{NH}_3 = \text{NH}_4\text{NO}_3.$

*Characters and Tests.*—A white crystalline salt. Its aqueous solution should give no precipitate with nitrate of silver, or chloride of barium, showing absence of chlorides and sulphates, respectively. Heated with a fixed base, e. g. caustic potash, it evolves the volatile base, ammonia; and, with sulphuric acid, the more volatile nitric acid. When raised to a temperature of about  $400^\circ$  it apparently begins to boil, but really undergoes complete decomposition into nitrous oxide gas and steam.  $\text{NH}_4\text{NO}_3 = 2\text{H}_2\text{O} + \text{N}_2\text{O}.$

One ounce of the salt furnishes about 500 cubic inches of nitrous oxide.

*In Pharmacy.*—Seldom or never prescribed internally, and of interest only as the source of nitrous oxide, the properties and effects of which will be now described. The salt must be pure, and free from chloride of ammonium especially, else the gas given off will contain chlorine and be unfit for inhalation.

### NITROUS OXIDE.

*Characters.*—Nitrous oxide (protoxide of nitrogen : laughing gas) is a colourless gas with a faint sweetish odour and taste, and soluble in about  $\frac{3}{4}$  of its bulk of cold water. It can be liquefied and even frozen, and is chemically a neutral body, but supports combustion with facility because hot bodies decompose it into nitrogen gas and free oxygen.



Discovered by Priestley in 1776, it was physiologically investigated by Sir H. Davy in 1800, and its anæsthetic properties were discovered by Dr. Horace Wells, a dentist of Connecticut, in 1844, but it was not till twenty years afterwards that it came into general use, and was introduced into London in 1868 by Dr. Evans, of Paris.

*In Medicine.*—This gas has long been known by the name of *laughing gas* because, when inhaled in small quantities, mixed with a large proportion of air, it produces in some persons a peculiar exhilaration, often attended with an irresistible propensity to muscular exertion, and to uncontrollable laughter. When inhaled pure, and quite free from air, its effects are first excitant, and then anæsthetic. “After a few seconds, varying from twenty to thirty, slight lividity of the face is noticed; this gradually increases till, between fifty and sixty seconds, in some cases longer, from the commencement of the inhalation, the lividity becomes extremely well marked. Generally slight twitchings of the hands, and some unsteadiness of the eyes now occur; the pupils are slightly dilated, and the breathing is slower and deeper than natural.” (Squarey.)

It is a rapid and pleasant anæsthetic; safe, when used with care, and followed by a speedy and complete recovery. From  $1-1\frac{1}{2}$  minutes is the average time required to produce anæsthesia, and recovery is usually accomplished within two or three minutes.

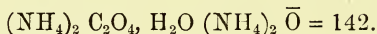
Although anæsthesia has been kept up by nitrous oxide for an hour, it appears to be best adapted for short operations, e. g. extraction of teeth, and it is not suited for eye operations, or whenever muscular relaxation is required.

Nitrous oxide when respired does not undergo any decomposition, and seems to produce its anæsthetic effect by arresting oxidation of the nervous centres. It causes cessation of the functions of the brain proper, before those of the medulla oblongata, and of the medulla before it paralyzes the heart.

The signs of danger are slowness and shallowness of the respirations and unsteadiness of the pulse, and the treatment to be adopted in any alarming case consists in at once commencing artificial respiration.

The most convenient and portable apparatus for its use is an iron cylinder ( $12\frac{1}{2} \times 3\frac{1}{2}$  inches) containing 100 gallons of the compressed and liquefied gas, connected with a Cattlin's inhaling bag and a Clover face-piece which fits well over the mouth and nostrils so as to prevent admixture of air. Searle's oxygenous aerated water is water impregnated with about five times its volume of this gas, and has been used to some extent as an internal remedy, as a tonic and diuretic.

#### AMMONIÆ OXALAS. (App. I.)



*Preparation.*—Neutralise a solution of oxalic acid with carbonate of ammonia.

*In Pharmacy.*—A solution of oxalate of ammonia (App. II.) 1 in 40, is used as a test for lime.

#### AMMONIÆ PHOSPHAS.



*Preparation.*—This salt is prepared in an analogous manner to the benzoate, i. e. by direct neutralisation of the acid with strong solution of ammonia, keeping the ammonia in slight excess so as to prevent the formation of acid phosphate.

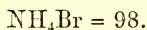
*Characters and Tests.*—The crystals, which are transparent when recent, become opaque on exposure and lose both ammonia gas and water. The salt is soluble in two parts of water, but, unlike the benzoate, it is insoluble in spirit. When heated with a fixed base, e. g. potash or soda, the volatile base, ammonia, is necessarily evolved. Like all the soluble salts of

tribasic (ortho-) phosphoric acid, it gives a *yellow* precipitate with nitrate of silver. The quantity of phosphoric acid in a given weight of the salt is estimated by precipitating it as triple phosphate ( $\text{MgNH}_4\text{PO}_4$ ), by addition of ammonio-sulphate of magnesia (magnesian mixture). This precipitate, when dried and ignited, and so converted into pyrophosphate of magnesium ( $\text{Mg}_2\text{P}_2\text{O}_7$ ), should weigh a little more than  $\frac{4}{5}$  of the original quantity of the salt operated on.

*In Medicine.*—This compound was introduced by Dr. Buckler, on theoretical grounds, as a remedy for gout and rheumatism, but it has not come into general use.

The average dose is 10 or 15 grs. dissolved in water.

## AMMONII BROMIDUM.



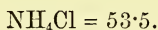
*Preparation.*—May be prepared by saturating hydrobromic acid with ammonia.  $\text{HBr} + \text{NH}_4\text{HO} = \text{NH}_4\text{Br} + \text{H}_2\text{O}$ .

*Characters and Tests.*—The white crystals gradually become yellowish on exposure to the air, in consequence of a little bromine being set free, but the salt is sufficiently stable to bear sublimation without change. The presence of iodide in the bromide is easily ascertained by adding a little solution of bromine (or chlorine), which at once liberates iodine, recognisable by the starch test.

*In Medicine.*—In its general effects it seems to resemble bromide of potassium, and, in some cases, is better tolerated by the system. It has been used principally in epilepsy, and various functional nervous diseases, and is considered by Dr. Gibb as a specific sedative to the pharyngeal and laryngeal mucous membrane. In whooping cough it is specially recommended, and is held to be a sedative towards ovarian and uterine irritations.

The average dose is about 10 grs., dissolved in water.

## AMMONII CHLORIDUM.



*Preparation.*—This salt, the well-known sal-ammoniac (so-called because originally prepared from camels' dung, in the neighbourhood of the temple of Jupiter Ammon), from which the other ammoniacal compounds used in medicine are directly or indirectly prepared, is obtained on the large scale by neutralising the "ammoniacal liquor" of the gas works with hydrochloric acid,  $\text{NH}_3 + \text{HCl} = \text{NH}_4\text{Cl}$ . Hence its old names, hydrochlorate, or muriate, of ammonia; it is now named chloride of ammonium, in conformity with the nomenclature of the other alkaline salts. The crude, greyish crystals, prepared as above, are purified by sublimation, and the drug is found in commerce in large hemispherical cakes with a round hole in the centre.

*Characters and Tests.*—Sal-ammoniac is easily recognised by its translucent fibrous appearance and its pungent saline taste. Its taste is peculiarly disagreeable; the addition of liquorice serves to disguise the flavour. Sp. gr. 1.45. It is inodorous, and, at a red heat, sublimes without decomposition. It is so tough that it is difficult to powder, but the granulated salt obtained from a boiling saturated solution, by stirring it as it cools, is readily pulverised. Soluble in one part of boiling water, and in three of cold. Its solution is attended with considerable reduction of temperature. Less soluble in rectified spirit, and sparingly so in absolute alcohol. When heated with any fixed base, such as potash or lime, ammonia gas is evolved; like all soluble chlorides it gives a curdy white precipitate with nitrate of silver.  $\text{AgNO}_3 + \text{NH}_4\text{Cl} = \text{AgCl} + \text{NH}_4\text{NO}_3$ .

*In Pharmacy.*—Liq. Amm. Fort. is prepared from sal-ammoniac, and a solution of chloride of ammonium (App. II.) is used in testing for magnesia. Sal-ammoniac increases the solubility of corrosive sublimate in water, and probably forms with it a

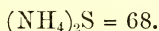
double salt,  $\text{HgCl}_2$ ,  $2\text{NH}_4\text{Cl}$  (*sal alembroth*) as in the Liq. Hydr. Perchlor.

*In Medicine.*—In common with the other ammoniacal compounds, chloride of ammonium is a tolerably active stimulant, is reckoned a diaphoretic, and, in large doses, is purgative. It is also considered to act as a special stimulant to the uterus, and is sometimes employed in amenorrhœa, and over inflammatory and congestive affections of the liver it appears to exert a most salutary effect. By some it is held to be the most powerful functional restorative of the secretion of bile, for example, in cases of acute jaundice traceable to nervous disturbance. It is frequently a very effectual remedy in some forms of pain, e. g. myalgia, hemicrania, *tic douloureux*, and sciatica, and is then best given in full doses. In chronic rheumatism and in chronic bronchitis, accompanied with tough and tenacious sputa, it has also acquired some reputation. It passes out unchanged in the urine.

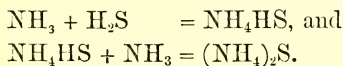
Externally, sal-ammoniac in solution, 1 in 10, forms a convenient cooling lotion for contusions, sprains, &c. Rubbed over warts three or four times daily it is said to remove them rapidly.

The full dose internally is 20 to 30 grs.

## AMMONII SULPHIDUM (APP. II.)



*Preparation.*—Pass a current of sulphuretted hydrogen into Liq. Ammoniæ so long as the gas continues to be absorbed; then add more Liq. Ammoniæ, and preserve the solution thus obtained in a well-closed green glass bottle.



*Characters.*—A colourless and very fetid liquid, becoming yellow by age. It should not be kept in white glass bottles on

account of the presence of lead in them, which is attacked by the sulphide of ammonium.

*In Pharmacy.*—This solution occurs in App. II., and is used solely as a test for certain metals, e. g. Cu and Zn. (See note on Sulphuretted Hydrogen in App. I.)

## AMYGDALA AMARA.

## AMYGDALA DULCIS.

*Origin.*—Almonds are the seed or kernel of the fruit of different varieties of *Amygdalus communis*, N. O. Rosaceæ. The bitter, distinguished from the ordinary sweet (Jordan) almonds by being broader and shorter, are imported from Mogador, but are obtained chiefly from Morocco. The sweet, or long pointed almond, is cultivated extensively in the south of Europe. It is said that in the Palatinate bitter almonds are not unfrequently gathered from the sweet almond tree.

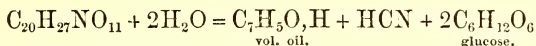
*Characters.*—Almonds should be entire, dry, white, and brittle. When injured by keeping, or of bad quality, they are soft, flexible, and translucent.

The peculiar odour of *bitter* almonds when bruised with water, is due to the evolution of hydrocyanic acid and of volatile or essential oil of almonds, and the cause of their formation is as follows:—Both kinds of almond contain an albumenoid substance called emulsin or synaptase, which undergoes no change of itself. In the *bitter* almond alone, in addition, 1 or 2% of a white crystalline nitrogenous substance termed amygdalin ( $C_{20}H_{27}NO_{11}$ ) occurs, which is also stable by itself.

But if emulsin be brought into contact with amygdalin in the presence of cold water, the emulsin acts as a ferment, and, without undergoing change itself, causes the amygdalin to split



up into essential oil of almonds (hydride of benzoyl), prussic acid, and sugar (glucose):—



Some formic acid is also produced by secondary decomposition of the prussic acid.

Neither the volatile oil nor the prussic acid exists ready formed in the bitter almond, but it is now plain why bitter almonds have caused death when swallowed in any quantity, owing to the prussic acid produced. If amygdalin be first injected into the blood of animals, and, in an hour afterwards, emulsin, death speedily ensues; but not so if the conditions be reversed (Husemann). Boiling water coagulates the emulsin and arrests its fermenting power. If a grain or two of amygdalin be triturated with an emulsion of *sweet* almonds, the odour of essential oil of bitter almonds is at once developed. The prussic acid which exists in variable quantity in laurel water is derived from a similar reaction to that described. (See Aqua Laurocerasi.)

Mustard is a parallel instance of an analogous phenomenon taking place, the volatile oil in its case being also a product, and not an educt. (See Sinapis.) It is stated that the albuminous matter from other seeds, e. g. poppy and hemp, is capable of playing the same part as emulsin with water and amygdalin; but the action is slower and less decided.

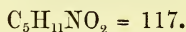
Both sweet and bitter almonds yield by expression a large quantity of a fixed or non-volatile oil. (See Oleum Amygdalæ.) For the sake of clearness the chief constituents of bitter and sweet almond may be placed side by side as follows:—

BITTER.	SWEET.
Fixed oil.	Fixed oil.
Emulsin.	Emulsin.
Amygdalin (yields by decomposition prussic acid, &c.)	None.

*In Pharmacy.*—Almonds should always be blanched before use for any purpose, because the seed-coat disagrees with many people, and produces nausea, and sometimes urticaria.

*In Medicine.*—Sweet almonds are simply nutrient and demulcent, and the *Mist. Amygdalæ*, prepared from *Pulv. Amygd. Co.*, is an agreeable vehicle for the administration of other remedies, especially in pectoral complaints, or in diseases attended with irritation of the intestinal or genito-urinary tract. Almond bread has been recommended as an ingredient in the diet of diabetic patients; and bitter almond emulsion is sometimes used to allay itching, and as a lotion in various skin affections.

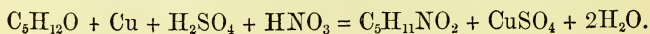
### AMYL NITRIS.



This remarkable body was discovered by Balard in 1844, more fully investigated by Guthrie in 1859, and again taken up and examined thoroughly by Dr. B. Ward Richardson in 1863-64.

*Preparation.*—It may be obtained by the action of nitrous acid on amylie alcohol, or by a process analogous to that for procuring *Sp. Æther. Nitr.*

To the *purified* amylie alcohol (fousel oil) introduced into a glass retort, containing some copper wire, is added  $\frac{1}{10}$  of its bulk of sulphuric acid. The same quantity of nitric acid, diluted with an equal volume of water, is next added, and a gentle heat applied at first, so as to start the distillation. More nitric acid is gradually supplied, until nearly the whole of the amylie alcohol is exhausted, and the distilled product, when washed with solution of soda, to remove hydrocyanic and other free acids, and rectified over fused potassic carbonate to get rid of moisture, is sufficiently pure for medicinal use. The reaction may theoretically be expressed :—



*Characters and Tests.*—This, the second officinal compound ether, is the homologue of nitrite of ethyl (Spir. Æther. Nitr.), which bears the same relation to ordinary ethylic alcohol that nitrite of amyl bears to amylic alcohol.

Its odour is peculiar, and has been compared to that of over-ripe pears. It is almost insoluble in water, but freely soluble in ordinary alcohol, ether, chloroform, and benzine, and is itself a solvent of fats and oils. It has been shown that much of the commercial amyl nitrite is very impure, and it is liable to contain appreciable quantities of prussic acid.

Other impurities are ethyl-amylic ether and amylic aldehyd, and the presence of these impurities probably accounts for the unpleasant symptoms sometimes observed to follow its use.

*In Medicine.*—The most striking effects experienced on inhaling three or four minims of this ether, are an almost instantaneous and extraordinary flushing of the face, and amplification with increased frequency of pulse. It sometimes causes a little breathlessness, or, again, giddiness, and a feeling of intoxication. Its great value lies in its power of affording instant relief in cases where pain is due to arterial spasm. In no disease is its influence more conspicuous than in arresting or preventing the dreadful heart-pangs of angina pectoris. In some cases a few sniffs of the drug invariably have the effect of almost instantly dispelling the paroxysm. (See a remarkable case in Dr. W. Madden's personal experience. *Practitioner*, Dec., 1872.) It has also been used in traumatic tetanus, spasmodic asthma, cardiac dyspnœa, syncope, laryngeal spasm in phthisis, and in intestinal colic, and hemicrania, often with the most prompt and unmistakable relief. Dr. Crichton Browne has observed that epileptics are particularly susceptible to its flushing influence, and he thinks that this agent will supersede other methods of attempting to avert the fit by acting upon indications afforded by the aura. A vinaigrette, or small-stoppered bottle, carried in the pocket, will probably be

found a safeguard to many sufferers from epilepsy. Even in the fully developed *status epilepticus*, under the agency of the nitrite, several patients have rallied from what was apparently a hopeless condition, the breathing became freer, and the circulation was relieved.

### AMYLUM.\*

*Origin.*—Starch is a generic term for a proximate principle found in most plants, but very abundantly in the seeds of all grasses, in tuberous roots or stems, e. g. arrowroot and potato, and in fleshy seeds such as beans and chestnuts.

Wheat starch, the product of *Triticum vulgare*, N. O. Gramineæ, is the variety recognised in the Pharmacopœia, but, from whatever source derived, the composition is constant, and is represented by the formula,  $C_6H_{10}O_5$ . Starch forms about 72% of wheat flour, and is separated from the gluten of the seed by prolonged washing with successive portions of cold water.

*Characters and Tests.*—The white columnar masses resulting from the drying of starch, have a somewhat crystalline aspect, and emit a peculiar crackling sound when pressed between the fingers. Sp. gr. 1.5. Under the microscope, starch is seen to consist of small ovoid or angular transparent granules (first observed by Leeuwenhoek in 1716), with concentric markings upon their surface, indicating the superposed layers of which they are made up. It should be neutral to test-paper, but some acetic acid is apt to be developed if starch be kept in a moist state. Starch is sometimes adulterated with chalk, pipeclay, gypsum, &c., and, in a moist atmosphere, it will absorb 12% of water without any obvious change. Admixture with potato starch would be shown by iodine striking a blue colour with the

\* 'A, priv.; *μύλη*, a mill; the term originally denoted a powder obtained without the intervention of a mill.

filtered liquid obtained by triturating it with cold water, some of the potato-starch passing through; but the best means of detecting the presence of other kinds of starch is by the use of the microscope, with or without the aid of polarised light.

Its distinctive colour-test is iodine, which gives with it a tint varying with the relative amounts of starch and iodine. A weak solution of iodine with a *cooled* aqueous decoction of starch gives a fine violet-blue. The decoction must be cooled before applying this test, because the blue colour of the iodide of starch is discharged by a heat of about  $200^{\circ}$ , although it partially reappears on cooling. By boiling, the colour is permanently lost. Iodine, if in combination, as in iodide of potassium, must first be liberated by adding a little nitric acid, or a drop or two of chlorine water, avoiding excess of chlorine, which would convert the iodine into chloride of iodine and into iodic acid ( $\text{HIO}_3$ ). Starch, when boiled with water, forms a mucilage, or paste but is not truly dissolved. If heated with dilute sulphuric acid, a soluble isomeric compound, dextrin (British gum), is formed, and eventually grape sugar (glucose) is produced. Powdered starch is used in making the three new suppositories in the Additions to the B. P. (Suppos. Ac. Carb.  $\bar{c}$ . Sap.; Suppos. Ac. Tann.  $\bar{c}$ . Sap.; Suppos. Morph.  $\bar{c}$ . Sap.)

*In Pharmacy.*—The mucilage of starch enters into the composition of four out of the six Enemata, and, like gum, it may be employed for suspending or emulsifying various drugs.

*In Medicine.*—Starch is nutrient and demulcent, and is extensively used as a dietetic in its various forms of arrow-root, tapioca, and sago, as well as in its natural combinations, such as oatmeal, barley, rice, &c. In cases of irritant poisoning by iodine, starch is the proper antidote. Dusted in powder over the skin, it is sometimes used in erysipelas, and to prevent excoriation when irritating secretions abound, and to relieve pruritus. The Glycerinum Amyli ("Plasma") affords a useful emollient application for external use. In surgery, starch

bandages are in frequent demand for the fixation of fractured limbs, diseased joints, &c.

### ANETHI FRUCTUS.

*Origin.*—This, the first of the small seed-like fruits, is the product of *Anethum graveolens*, N. O. Umbelliferæ.

Several others are commonly met with, viz., Anise, Caraway, Fennel, Coriander, and Hemlock. They are easily known to be *fruits*, and not seeds, as they are popularly called, by their presenting the remains of the style; while, moreover, the seed can by careful dissection be separated from the seed coat.

Dill fruit is the only flat, oval Umbelliferous fruit with a membranous wing.

*In Medicine.*—All these small fruits, except Conium (Hemlock), are aromatic stimulants, and they owe this property to a volatile oil. Dill water may be given to children as a carminative in doses of ʒij.—ʒss., or employed as a vehicle for other medicines, but it is seldom prescribed.

### ANTHEMIDIS FLORES.

*Origin.*—The flower-heads of the common (Roman) chamomile,\* which resemble those of the daisy, are derived from *Anthemis nobilis*, N. O. Compositæ. The plant is indigenous in dry and gravelly situations, and is specially cultivated at Mitcham and elsewhere. By cultivation, the single flower-heads (Scotch chamomile) are often changed into double capitula (English chamomile), i. e. the yellow *tubular* disk-florets are converted into white *strap-shaped* florets more or less completely, and there is every gradation observed between these.

*Characters.*—The aromatic qualities of chamomile are due to the volatile oil, and since this resides chiefly in the yellow tubular florets, the single flower heads are to be preferred for

\* *Χαμαί*, on the ground; *μῆλον*, an apple; from the odour of the flowers.



medical use, although the double heads are more commonly cultivated on account of their showiness. The flowers also contain a bitter extractive principle, soluble in water and alcohol, and a small quantity of tannin.

Occasionally the flowers of other Composite plants are intermixed, and can only be detected by careful examination. The common wild (German) chamomile, a roadside weed, is *Matricaria Chamomilla*.

*In Medicine*.—Internally, chamomile is chiefly used as an aromatic bitter tonic in dyspepsia, and general debility, with enfeebled appetite, &c. In large doses it is apt to act as a nauseant; and the warm infusion (chamomile tea) is sometimes given to promote the operation of emetics.

Externally, an infusion is in common use as a fomentation in mild cases of inflammation of the eye, and in bruises, sprains, &c.

The dose of the Infusion is  $\mathfrak{z}\text{i}$ . and upwards.

Chamomile ointment has been employed in France as a remedy for scabies.

### *ANTIMONY.\**

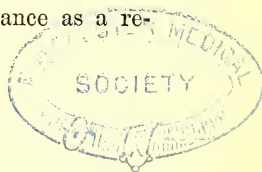
Sb = 122.

*Origin*.—Antimony, the basis of some important preparations, is a greyish-white, heavy, lustrous element, formerly classed as a metal, but now reckoned with the metalloids on account of its chemical analogies.

The common ore of antimony is the black sulphide (stibine),  $\text{Sb}_2\text{S}_3$ , from which, directly or indirectly, all the other preparations are derived.

\* *Apri*, against, and *moine*, Fr., a monk; because some monks were poisoned by its compounds. The use of antimonials was formerly strictly proscribed in France under severe penalties.

Possibly, the word is a corruption or imitation of the Arabian term for this element, *atimad*. (Stillé.)



*Chemical Relations.*—Like Arsenicum, with which it has marked affinities, it is a pentad, i. e. is capable of combining with five atoms of a monad such as chlorine, e. g.  $\text{SbCl}_5$ , but in all its officinal compounds it exerts trivalent activity, e. g.  $\text{SbCl}_3$ ,  $\text{Sb}_2\text{O}_3$ .

Salts of antimony are generally decomposed by water, forming an insoluble subsalt which precipitates, and a strongly acid salt which remains in solution.

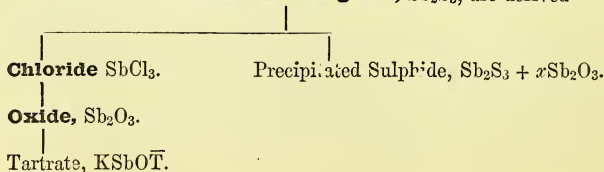
The general *test* for antimony in solution is the production, with sulphuretted hydrogen, of an *orange* precipitate,  $\text{Sb}_2\text{S}_3$ , which is insoluble in acids but soluble in alkalies. Antimonious sulphide is the only orange-coloured sulphide.

The subjoined scheme shows the mutual relations of the preparations to each other:—

1. Native impure black sulphide (Antimonium Nigrum),  $\text{Sb}_2\text{S}_3$ .
2. Precipitated golden sulphide (Antimonium Sulphuratum),  $\text{Sb}_2\text{S}_3$  + some  $\text{Sb}_2\text{O}_3$ . Dissolve No. (1) in caustic soda and precipitate with sulphuric acid.
3. Chloride of Antimony (Liquor Antimonii Chloridi),  $\text{SbCl}_3$ . Dissolve (1) in hot hydrochloric acid.
4. Oxide of Antimony (Antimonii Oxidum),  $\text{Sb}_2\text{O}_3$ . Precipitate oxychloride of antimony by pouring (3) into water, and convert into pure oxide by washing with carbonate of sodium.
5. Tartar emetic (Antimonium Tartaratum),  $\text{KSbO}_3$ . Dissolve (4) in cream of tartar, KHT.

### GENEALOGICAL TABLE OF THE ANTIMONIAL COMPOUNDS.

From the native **Antimonium nigrum**,  $\text{Sb}_2\text{S}_3$ , are derived—



*General Therapeutical effects.*—All the antimonial preparations are, in full doses, emetic or purgative, but tartar emetic is the only preparation soluble in water without decomposition, and is the most certain in its effects. In small doses they are sedative, diaphoretic, and nauseant, and are frequently prescribed in febrile conditions, in the early stages of pneumonia and bronchitis, and in the commencement of inflammatory affections of the head.

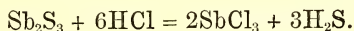
The special therapeutical history of antimony will be given under Antimonium Tartaratum.

Metallic antimony was formerly employed, and as pills composed of it passed through the system unaltered, and were then considered fit for administration to others, they were termed “everlasting pills.” In this fashion a single pill might serve a whole family during their lives. Cups made of an alloy of antimony and tin, and in which wine was allowed to stand, were termed “pocula emetica.”

## ANTIMONII CHLORIDI LIQUOR.

An impure solution of chloride of antimony,  $\text{SbCl}_3$ , in hydrochloric acid.

*Preparation.*—Dissolve black sulphide of antimony (the prepared native ore) in hydrochloric acid,



The operation must be conducted beneath a flue, with a good draught, in order to carry away the offensive and poisonous fumes of sulphuretted hydrogen.

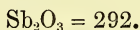
*Characters and Tests.*—Sp. gr. 1.47. When deep red in colour it is impure from the presence of ferric chloride or nitrate. Dropped into water it gives a dense white precipitate of oxy-chloride of antimony (Pulvis Algarotti),  $12\text{SbCl}_3 + 15\text{H}_2\text{O}$

=  $2\text{SbCl}_3$ ,  $5\text{Sb}_2\text{O}_3$  +  $30\text{HCl}$ . This white precipitate is turned *orange* by sulphide of hydrogen; a bismuthous precipitate would be turned black. Tartaric acid prevents the formation of Pulvis Algarotti on dilution, but does not interfere with the production of the characteristic orange precipitate with sulphide of hydrogen. The test in the Pharmacopœia corresponds to 36·7% of antimonious chloride,  $\text{SbCl}_3$ . When Liq. Antim. Chlor. is distilled, the water and the excess of hydrochloric acid first come over, and finally pure chloride of antimony volatilises and concretes on cooling into a white, readily fusible, unctuous solid, to which the term *butter of antimony* was formerly applied. This name is now usually extended to the officinal solution; similarly chloride of zinc is called *butter of zinc*.

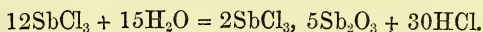
*In Pharmacy.*—Chloride of antimony is employed in the preparation of pure oxide of antimony.

*In Medicine.*—Never used internally, but occasionally it is employed as a caustic in poisoned wounds, syphilitic sores, and ulcerated sore throat. It does not cause much pain or subsequent inflammation, and, after the separation of the eschar, produces a clean, healthy surface.

## ANTIMONII OXIDUM.



*Preparation.*—(a). Pour Liq. Antim. Chlor. into excess of water; a white precipitate of oxychloride of antimony falls down. (Pulvis Algarotti.)\*

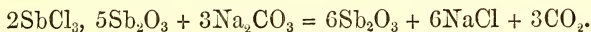


The composition of this precipitate is not uniform, but varies with the amount of water employed and the length of time

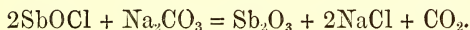
\* Algarotti was an Italian physician of the sixteenth century.

during which it is washed. Some chemists write its formula more simply, as  $\text{SbOCl}$ , and then the reaction would be  $\text{SbCl}_3 + \text{H}_2\text{O} = \text{SbOCl} + 2\text{HCl}$ .

(b). Wash the precipitate by decantation to get rid of hydrochloric acid, and decompose the oxychloride by sodic carbonate, which precipitates pure oxide of antimony.



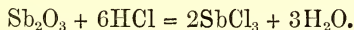
or,



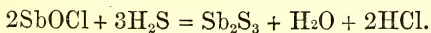
The sodic chloride is washed away with boiling water, and the residual precipitate of antimonious oxide is dried at a temperature not exceeding  $212^\circ$ , to avoid absorption of oxygen and formation of higher oxides of antimony ( $\text{Sb}_2\text{O}_4$  and  $\text{Sb}_2\text{O}_5$ ).

*Characters and Tests.*—Heat first renders it yellow; a stronger heat fuses it, and at a full red heat it sublimes in crystalline needles. Like all the heavy oxides it is insoluble in water, and is therefore tasteless; but it is readily soluble in acetic, hydrochloric, or tartaric acids, and in cream of tartar, with which it forms tartar emetic. If any of the other oxides of antimony be present, the sample will not be *entirely* soluble in these reagents; hence cream of tartar ( $\text{KHT}$ ) is used as a test of its purity.

Treated with hydrochloric acid, antimonious chloride is formed—



This, as we have seen, gives Algarotti's powder, when dropped into water, and sulphide of hydrogen at once changes the white precipitate to orange—



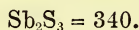
*In Pharmacy.*—Employed in the preparation of tartar emetic,

and, when mixed with twice its weight of phosphate of lime, it constitutes Pulvis Antimonialis, the officinal substitute for "James' powder."

*In Medicine.*—This is the only medicinally active oxide of antimony ; but, on account of its insolubility, its emetic action is less marked than that of tartar emetic, nor is it so certain in its effects.

The dose for an infant is from  $\frac{1}{4}$  to  $\frac{1}{2}$  grain, for a young child about 1 grain, and for an adult up to 3 grains.

### ANTIMONIUM NIGRUM.



The impure sulphide is the common ore of antimony. This, when freed from siliceous and earthy impurities by fusion, and powdered, constitutes the prepared sulphide of the Pharmacopœia.

*Characters and Tests.*—In commerce, it occurs in fused conical masses (crude antimony) of a steel grey colour, and striated crystalline appearance, not unlike plumbago (black lead). If properly purified, it should dissolve almost entirely in hydrochloric acid by the aid of heat, and furnishes a convenient mode of preparing sulphuretted hydrogen gas.



The mineral is apt to contain iron, arsenic, lead, or copper.

*In Pharmacy.*—Used in the preparation of the golden sulphide of antimony (Antim. Sulphuratum), and of butter of antimony (Liq. Antim. Chlor.)

*In Medicine.*—Was formerly employed internally, but is now abandoned in favour of the other antimonial preparations which are more certain in action.

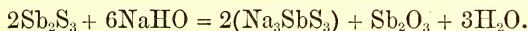


It has been known from ancient times, and was used by the Hebrew women to blacken their eyebrows, a custom which still lingers among the Turks.

### ANTIMONIUM SULPHURATUM.

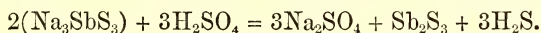
An oxysulphide of antimony consisting mainly (over 90%) of  $\text{Sb}_2\text{S}_3$ , with a small and variable amount of  $\text{Sb}_2\text{O}_3$ .

*Preparation.*—(a). Black sulphide of antimony is boiled with caustic soda—



In the *hot* alkaline solution no precipitation occurs; but, if allowed to cool, a precipitate of variable composition will fall down.

(b). Dilute sulphuric acid is added to the liquid before it cools—



The acid re-precipitates the oxide of antimony which was held in solution by the soda as  $\text{NaSbO}_2$ ; and, also any excess of  $\text{Sb}_2\text{S}_3$  that was dissolved in the alkaline solution. The  $\text{Sb}_2\text{O}_3$  and  $\text{Sb}_2\text{S}_3$  combine and form the golden oxysulphide.

*Characters and Tests.*—Several forms of brown or reddish oxysulphide are known to chemists, and have long been called *Kermes Mineral*, on account of their resemblance in colour to the insect Kermes, an old name for a species of cochineal. Like oxide of antimony, the oxy-sulphide dissolves in solution of cream of tartar, and the antimony can then be detected by sulphuretted hydrogen, giving the characteristic orange-red precipitate of  $\text{Sb}_2\text{S}_3$ . The hydrochloric solution ( $= \text{SbCl}_3$ ) dropped into water gives a white precipitate of oxychloride (*pulvis Algarotti*).

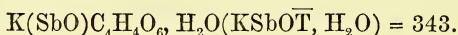
It is said to be sometimes adulterated with sand, ferric oxide, and red sandal wood. When pure it is tasteless; but occasion-

ally it has a slightly styptic taste. When heated it takes fire, and burns with a greenish-blue flame, giving off  $\text{SO}_2$ . Exposure to light and air causes partial decomposition, with separation of sulphur.

*In Pharmacy.*—Enters into the preparation of Plummer's calomel pill (Pil. Hydr. Subchlor. Co.)

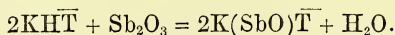
*In Medicine.*—It is uncertain in its action, and is rarely given alone; but, in the form of Plummer's pill, it is much used in secondary and visceral syphilis; the principal effects of the pill being, however, due to the calomel.

### ANTIMONIUM TARTARATUM.



This salt was discovered in 1631 by Adrian de Mynsicht, and its name has undergone nearly as many changes as that of corrosive sublimate.

*Preparation.*—Tartar emetic, like all the other tartrates, is prepared from cream of tartar. If  $\text{SbO}$  be substituted for  $\text{H}$  in the acid tartrate of potassium, we get tartar emetic. Mix oxide of antimony with cream of tartar, and a little water.

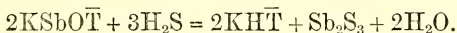


In the cold the oxide of antimony and cream of tartar require twenty-four hours for complete reaction; boiling facilitates the combination.

*Characters and Tests.*—The crystals, although transparent when recent, effloresce slightly, and become opaque and brittle on exposure to the air. They are rhombic octahedrons, and possess a peculiar, metallic, disagreeable taste. The crystals should always be preferred to the powder, as being less liable to impurities. If the powder be yellowish-white, the presence of iron is indicated.

Readily soluble in two or three parts of boiling water, and in twelve or fifteen parts at 60°; less soluble in proof spirit or in wine, and insoluble in absolute alcohol. Cream of tartar, a common impurity, is very sparingly soluble in cold water. The aqueous solution of tartar emetic slightly reddens litmus; it becomes mouldy by keeping, a low form of vegetation (*Sirocrocis tartarica*) being developed, similar to that which forms in solutions of tartaric acid, as well as of the tartrates generally. The addition of a little spirit of wine prevents this. With hydrochloric acid, chloride of antimony is formed, which decomposes, in presence of water, into oxychloride, a white precipitate (*Pulvis Algarotti*). This is redissolved by tartaric acid, and does not appear at all if tartaric acid be previously added to the solution. This latter character distinguishes antimonial from bismuthous salts, which also give precipitates with water, but these are not redissolved by tartaric acid.

With sulphide of hydrogen the characteristic orange-red precipitate of antimonious sulphide is formed—



This orange precipitate is quickly converted into the black sulphide by heat. The solution should be acid, or, at least, not alkaline, for  $\text{Sb}_2\text{S}_3$  like  $\text{As}_2\text{S}_3$  is soluble in alkaline solutions; consequently, if excess of sulphide of ammonium be added to tartar emetic, no precipitation will occur.

*In Medicine.*—The full action of tartarised antimony is as an emetic as well as a sedative to the circulation. It excites most of the secretions, and hence, according to the dose and other circumstances, it will act as a diaphoretic, diuretic, or cathartic. It produces irregularity and slowness of the pulse, with depression of the nervous system and muscular power. The pulse may fall in two or three days from 72 to 44, usually about ten or twenty pulsations in the minute; and, if the temperature has been excessive, a reduction of several degrees may be obtained.

When tartar emetic is given in small doses continued through a long period of time, to a healthy person, poisonous effects result. Sickness and watery purging, diaphoresis without febrile excitement, a pustular eruption on the skin or palate, or a red efflorescence on the skin, symptoms of congestion of the lungs, with great weakness and emaciation, and ultimately death, are the results.

Tartar emetic should be given with extreme caution to young children and infants, an ordinary dose having proved fatal when given at an early age. (Waring.)

After absorption antimonials may be found in the blood, liver, and principal viscera, and they pass into the secretions of bile, milk, urine, and perspiration. Tartar emetic is one of those salts which do not coagulate albumen, and therefore it is easily taken up.

In small doses,  $\frac{1}{16}$  to  $\frac{1}{8}$  gr., combined with salines, such as nitre and sulphate of magnesium, it is much used in febrile complaints, erysipelas, in the early stage of acute local inflammations, e. g. gonorrhœa, and usually then proves diaphoretic. Similarly in the acute stage of pectoral inflammations it is constantly prescribed as a nauseant and expectorant, and it certainly seems to favour the expulsion of morbid exudations, and to promote the mucous secretion. In the treatment of these affections it is often associated with squill or ipecacuanha.

The effects of tartar emetic are modified, and to some extent neutralised by combination with opiates, and this alliance has been specially recommended by Blane and Graves in the intense cerebral excitement of severe continued fever. Tartar emetic has been frequently advocated in delirium tremens.

As an emetic, in one or two gr. doses, it is characterised by its energy and by the extreme nausea and prostration attendant on its action, and it is apt at the same time to cause bilious stools. Croup, whooping cough, and tonsillitis are the chief affections in which its emetic action is sought. It is contra-indicated whenever there is marked debility, or irritability of the stomach.

It is not so rapid in its emetic powers as sulphate of zinc or mustard, and may be advantageously assisted by Vinum Ipecac. (3i.—3ij.) If injected into the circulation at any part of the body it will equally bring on nausea and vomiting, i. e. it possesses a specific action on the stomach and intestinal canal.

Given in large doses, one or two grs. every two hours, a small quantity only of fluid being allowed, it is found that in acute inflammations, e. g. pneumonia, tolerance of the remedy, as regards the stomach, is soon established, and extraordinary benefits have been claimed to accrue from its use in this mode. Yet there is not real *immunity* from the action of the drug, for purgation is usually caused. But there is no solid advantage gained by giving these heroic doses, and all its desirable effects can be secured without ever passing a nauseant dose. It is probable that all its therapeutical effects are dependent on its primary nauseating influence and on the secondary nervous phenomena consequent on the nausea.

*Externally.*—Tartar emetic ointment is often serviceable in the relief of deep-seated pains, in incipient phthisis, hooping cough, &c. It brings out slowly a peculiar, angry, and painful pustular eruption (first described by Gaitshell about 1787), acniform pustules on a red base; and, if applied too long, troublesome ulceration, and even sloughing may follow. The eruption leaves permanent scars, and differs markedly from the discrete vesicular eruption caused by croton oil. Tartar emetic has the advantage over cantharides of not irritating the urino-genital organs. Malingerers sometimes use the ointment for their own purposes, and solutions of the salt have been fraudulently sold instead of vaccine lymph.

*Administration.*—Tartar emetic is nearly always given in solution, and the Vinum Antimoniale is a favourite preparation. The dose varies from  $\frac{1}{20}$  or  $\frac{1}{4}$  gr. up to one or two grs., according as a diaphoretic, nauseant diaphoretic, or emetic influence is de-

sired. The addition of Tinct. Lavand. Co. is said to correct the tendency to vomit. Its aqueous solution is nearly tasteless.

In cases of poisoning by antimonials ; tannin, and preparations containing tannic acid may be given as antidotes with the view of forming an insoluble tannate of antimony, while opium should be administered to check the vomiting and relieve pain. One fluid ounce of decoction of yellow cinchona bark will completely decompose  $\text{Æi.}$  of this salt. Messrs. T. & H. Smith have proposed a mixture of ferric chloride and calcined magnesia as an antidote.

## AQUA.

### AQUA DESTILLATA.

$$\text{H}_2\text{O} = 18.$$

The purest natural waters are rain and snow water, and, when collected in clean vessels in the open country, they will include little else than the gases taken up from the air. Many natural waters are *hard* (i. e. contain lime or magnesia in solution, and therefore curdle soap) and are then unfit for employment in pharmacy. Soft water extracts the soluble ingredients of vegetables more easily, and brewers make use of this fact in dissolving malt. Hard water is unsuited for making emulsions.

Since no natural water, even when cleared by filtration, is sufficiently pure for certain pharmaceutic purposes or for chemical experiments, distillation must be resorted to for these ends.

The still should be constructed of copper, and the worm or condenser of block tin, because ordinary tinned iron would be liable to be attacked by the water, and a leaden head or worm would be still more objectionable. If absolutely pure water be required, silver vessels are employed for the distilla-



tion, and in no case should the apparatus be used for any other purpose.

In conducting the distillation the first half-gallon of water which comes over is rejected, whereby the volatile impurities, such as carbonic anhydride, are got rid of. The whole of the quantity operated on is not to be distilled over, else the last portions will acquire an empyreumatic taste from the charring of the organic matter which collects on the side of the still. If, for example, ten gallons of water be subjected to distillation, eight gallons only should be preserved for use.

*Tests.*—Distilled water should be colourless, transparent, tasteless, and odourless. It is difficult to obtain distilled water absolutely pure, and not less so to preserve it in that state. Even recently distilled water often has a musty odour due probably to some organic impurity, which may be destroyed by peroxide of hydrogen. Solution of permanganate of potassium serves as a ready test for organic matter, which discharges the purple colour of the potassic salt.

If a fluid ounce on evaporation leaves no decided residue, the absence of fixed impurities and of much organic matter is ascertained, but the following additional tests should be applied.

(a). Sulphuretted hydrogen ( $H_2S$ ) would give a black precipitate with any of the ordinary heavy metals likely to be present, such as tin, lead, or copper.

(b). Oxalate of ammonia would precipitate lime or any soluble salt of calcium.

(c). Nitrate of silver, chlorides.

(d). Chloride of barium, sulphates, and

(e). Lime water, carbonic acid or carbonates.

*In Pharmacy.*—Ordinary water is frequently substituted for distilled water in the various operations of pharmacy, and in some cases the change would be attended with considerable disadvantages.

Water is the most general solvent we are acquainted with,

but it does not take up fats, nor, as a rule, bodies which are either highly hydrogenised or carbonised. It rapidly absorbs large quantities of some gases, e. g. hydrochloric acid, and ammonia (Ac. Hydrochl.; Liq. Amm. Fort.) In the Pharmacopœia, distilled water only is ordered in the preparation of most of the Liquors, some of the Liniments, Dilute Acids, all the Infusions and Decoctions; but, when prescribed, it is not always employed. It is essential in the preparation of collyria and lotions containing silver, mercury, calcium, lead, iron, or zinc, all of which would be precipitated by the constituents of ordinary water; and, in the solution of substances which, like permanganate of potassium, are decomposed by contact with organic matter.

*In Medicine.*—Water is employed therapeutically both cold and hot, and also in the state of ice and of aqueous vapour.

*Cold Water.*—The copious use of water promotes the renal or cutaneous excretions, according as the skin is kept cool or warm. Cold injections are thrown into the rectum to check hemorrhage, or relieve pain, and vaginal injections are valuable in cases of uterine hemorrhage. The effects of the cold *bath* vary according to the temperature; when below 50° F. it is considered very cold. The cold bath at 60°, is sometimes employed for the sake of the shock, and frequently on account of the reaction which follows its judicious use. It has recently been strongly advocated, in revival of Currie's practice, and extensively used as a refrigerant in febrile diseases, and more particularly in the continued fevers and in scarlatina. The reduction of temperature may sometimes reach 10° in the trunk, but is usually much less, and its effects are only temporary. Instead of the cold bath, packing in a wet sheet may be employed, and is a powerful means of bringing down the temperature. Cold *affusion* on the head is a valuable means of stimulation in syncope, narcotic poisoning, hysteria, epilepsy, and laryngismus stridulus. If continued longer it acts as a

sedative, and will often induce sleep in delirium tremens, and in the raving of fever even when opium has failed. Sponging the body is often to be preferred to affusion or the bath in fevers, and, in the case of infectious diseases, a small quantity of Condyl's fluid (permanganate of potash) may be added to the water.

The *shower bath*, a familiar form of affusion, is an admirable hygienic and tonic means, and is of great service in chorea, hysteria, and maniacal excitement.

*Ice*.—Pounded ice is applied to the head with signal benefit in cases of cerebral inflammation, and of brain irritation during fever. In tetanus an ice-bag laid along the spine has proved very useful.

Taken internally, and sucked in small quantity, ice is most grateful in acute tonsillitis and scarlatinal sore throat, is one of the best and safest modes of relieving febrile thirst, and will often check internal bleeding.

*Hot Water*.—The warm bath ( $92^{\circ}$  to  $98^{\circ}$ ) is a useful sedative, and an effectual means of inducing diaphoresis in cases of anasarca and chronic Bright's disease. In recession of the eruption in the exanthemata, in some chronic cutaneous diseases, attended with dryness of the surface, or obstinate thick crusting, and troublesome itching, it is highly serviceable.

In the convulsions of childhood, in colica pictonum, and various spasmodic affections, the hot bath is most efficacious.

Draughts of warm water greatly promote vomiting, and render the act much less distressing to the patient. Tepid or cold water thrown into the rectum is an admirable means of relieving simple constipation.

*Aqueous Vapour*.—The vapour bath is a powerful stimulant and sudorific, and is often extremely valuable in chronic rheumatism and gout, in catarrhal affections, certain cases of dropsy, and some skin diseases.

Inhalation of the vapour of warm water is an agreeable emollient in inflammatory affections of the fauces and pharynx, and gives great relief in acute laryngitis.

When the vapour is impregnated with volatile drugs we have a medicated inhalation, e. g. the officinal "Vapores."

The other officinal waters, thirteen in number, come under the head of "medicated waters," and they agree in holding in solution a small quantity of a volatile oil, except Aqua Chloroformi.

They are all prepared by distillation, except Aq. Camph. and Aq. Chlorof., and, although the process for distilling these waters appears very simple, yet it involves many practical niceties of detail. Accordingly the U. S. Pharmacopœia rejects altogether the process by distillation, and directs that water should be impregnated with the volatile oil by rubbing it up along with carbonate of magnesium, and then filtering. But this is apt to give rise to the formation of a magnesian compound.

Spirituous essences are unsuitable for the preparation of "Aquæ," because alcohol slowly changes into acetic acid in the distilled water. As a rule, maceration for a day and night previous to distillation, is highly advisable for all dried substances, except pimento.

Many medicated waters are harsh and musty at first, but by keeping they become mellow, possibly owing to a slow oxidation of the essential oil.

As to their medical properties most of these waters are gentle aromatic stimulants and carminatives; but they are chiefly used as vehicles for other remedies.

The dose of any of them, except laurel water, for an adult is  $\bar{3}$  i. to  $\bar{3}$  ij.

### AQUA ANETHI.

Dill fruit yields about 3·5% of essential oil, which closely resembles oil of caraway in taste and odour. 1 lb. of fruit yields  $\bar{3}$  ij. to  $\bar{3}$  vij. of oil. Sp. gr. of oil, 0·9; and it requires 1500 parts of water for solution.

This water possesses aroma, without bitterness. It is not in general use except for children's ailments.

## AQUA AURANTII FLORIS.

Although obtained indiscriminately from the flowers of the bitter and the sweet orange tree, those of the former yield the most fragrant product. Nearly an ounce of essential oil is procured from 500 pounds of flowers.

*Characters and Tests.*—If too much heat be employed in its preparation, coloured empyreumatic products may come over and impair its aroma. In any case it does not keep well, and might be expunged without loss. It sometimes contains a little copper, tin, or lead, from having been preserved in soldered copper bottles. Sulphuretted hydrogen would give a black precipitate with any of these metals.

## AQUA CAMPHORÆ.

The term “Aqua Camphoræ” is preferable to its synonym “Mistura Camphoræ,” as it does not include a second active ingredient.

This preparation is extremely feeble, owing to the sparing solubility of camphor in water, which dissolves scarcely one part in 1000, or, about 40 grains in a gallon. The water is simply flavoured with camphor, and is of use only as a vehicle for more active remedies.

## AQUA CARUI.

Caraway fruit contains a considerable proportion of volatile oil, about 4%. 1 lb. fruit yields from 5 iij. to 5 vij. of oil; sp. gr. 0·94.

This water is a favourite carminative with some.

## AQUA CHLOROFORMI.

A saturated aqueous solution of chloroform. 1 in 200. It will mix readily with any vehicle, and is of no value, except for its agreeable flavour.

## AQUA CINNAMOMI.

The volatile oil constitutes about 6 parts in 1000 of recently prepared bark; or 1 lb. of bark yields 3 i. to 3 iij. of oil; sp. gr. 1.006. This water is in much repute as a vehicle for, and corrective of purgative and nauseous medicines.

## AQUA DESTILLATA. (See p. 124.)

## AQUA FŒNICULI.

Fennel fruit contains nearly 2% of volatile oil; or 1 lb. fruit yields 3 ij. to 3 vi. of oil; sp. gr. 0.94.

The water is often prescribed to correct flatulence in children.

## AQUA LAUROCERASI.

The hydrocyanic acid and volatile oil, which exist in this water, do not occur pre-formed in the tissue of the leaf; but, as in the case of bitter almond, are derived entirely from the mutual reaction of two natural principles, probably amygdalin and emulsin. This is denied by Lepage, who has recently maintained that the volatile oil and prussic acid *pre-exist* in the cherry-laurel, and are developed during vegetation.

*Preparation.*—Since these two principles are found in different cells of the plant, it is necessary to chop and crush the leaves, in order to bring them into contact. The presence of cold water is requisite to the decomposition of the amygdalin under the fermenting influence of the emulsin, and maceration for twenty-four hours is enjoined, because the reaction takes place slowly. If the emulsin were coagulated by boiling water, no reaction would ensue. By distillation the volatile substances are separated from the non-volatile residue, and the product is shaken up, and filtered through paper, in order to absorb the excess of volatile oil. Finally, it is kept in a stoppered bottle,



to hinder evaporation of the acid or essential oil, and also to prevent the oxidation of the latter into benzoic acid. (See *Amygdala*.) In all, then, we have five steps:—(1.) crushing the leaves; (2.) maceration; (3.) distillation; (4.) filtration; (5.) preservation.

*In Medicine*.—The quantity of hydrocyanic acid, the sole active ingredient, contained in laurel water, is very variable, diminishes rapidly, and is seldom above 0·15%. As a sedative and antispasmodic it is a favourite remedy; but, on account of its uncertain strength and feebleness at best, it should not be allowed to take the place of the definite dilute solution of prussic acid, and its introduction into practice at all is to be regretted.

### AQUA MENTHÆ PIPERITÆ.

### AQUA MENTHÆ VIRIDIS.

These waters, although ordered to be prepared from the oil, and not from the fresh or dried plant, are sometimes distilled directly off the herb.

They are often used for concealing or modifying the taste of other medicines, and peppermint is one of the most efficacious carminatives in flatulent colic, while spearmint water is used to check vomiting.

### AQUA PIMENTÆ.

This water is a most unsatisfactory distillate, prone to rapid decomposition, which it appears difficult to prevent. It is brownish in colour, and gradually deposits a brown resinous sediment. 1 lb. fruit yields 3ij. to 3v. of oil; sp. gr. 1·02. Seldom used as a carminative.

### AQUA ROSÆ.

Roses are the most perishable of flowers, and, when it is desirable to keep the petals for some time before distilling, they

will retain their odour by being incorporated with one-third of their weight of common salt, and will afford a water equally fragrant with that obtained from the fresh flowers. 100 lbs. flowers yield 3 iij. of solid otto of roses.

According to Mr. Ince the quantity of water ordered in the Pharmacopœia is far too small, and, after distillation, twelve months should be allowed for the odour to be matured.

Rose water affords an elegant vehicle for collyria and other lotions.

### AQUA SAMBUCL.

The flowers contain but a small proportion, about 0.32% of yellow solid oil, and some manufacturers prefer in this case as well as in the last the salted flowers to the fresh. According to Mr. Ince the quantity of water should be about four times the amount ordered in the Pharmacopœia, and, after distillation, several months must be allowed for the perfume to be gradually elaborated. When first distilled the water has no appreciable taste or smell.

Occasionally used as a cosmetic and cooling lotion.

### ARECA.

*Origin and Characters.*—The betel nut or Areca seed is derived from an East Indian tree, Areca Catechu, N. O. Palma-cœæ. The brownish ovoid seed is contained within a yellowish fruit about the size of a hen's egg, and, on section, it presents a beautifully marbled and veined appearance ("ruminated albumen") somewhat like nutmeg, but the seed is very hard and inodorous. Its chief constituents are tannic and gallic acids, with red colouring matter.

*In Medicine.*—Has been introduced as a vermifuge in the treatment of tape-worm and round-worm, in which it is given, in powder, in doses of  $\frac{1}{2}$  to  $\frac{3}{4}$  ounce. The masticatory and

sialogogue so well known in the East by the name of *betel* consists of fragments of this nut sprinkled with lime, and rolled up in the leaf of the Piper Betel. The whole is then chewed and is considered to exercise a cleansing and preservative effect on the teeth. In this country areca-nut charcoal is used as a tooth-powder. A variety of *catechu* is prepared from areca-nut by evaporating the decoction.

## ARGENTUM\* PURIFICATUM.

Ag = 108.

*Source.*—Silver occurs in nature in the metallic state, but the principal ore is the sulphide, which is commonly combined with sulphide of lead forming argentiferous galena. In order to prepare pure refined silver from an alloy, say, of copper and silver, e. g. a silver coin.—Dissolve in nitric acid; to the solution of nitrates of copper and silver thus obtained add hydrochloric acid or any soluble chloride; chloride of silver is precipitated, and all the copper remains in solution. Collect the chloride of silver and fuse in a crucible with sodic carbonate; a deposit of pure silver is obtained which can be readily melted into a button. Or, the chloride of silver may be dissolved in ammonia, and the silver precipitated by immersing clean metallic copper in the solution.

*Chemical Relations.*—Silver is a heavy (sp. gr. 10·4) brilliant, ductile, and malleable metal, the whitest among the metals, but, when a ray of light is reflected several times from its surface, it appears yellow. It is not oxidised in the air, but tarnishes slowly from the formation of sulphide of silver owing to the presence of sulphuretted hydrogen in the atmosphere. In presence of ozone it undergoes oxidation.

Silver is a monad (i. e. unites with but a single atom of

\* "*Ἀργυρος*, silver, from *ἀργός*, white.

chlorine or any similar body); hence the formula of its oxide is  $\text{Ag}_2\text{O}$ , and of its nitrate,  $\text{AgNO}_3$ . It is the only *heavy* monatomic metal.

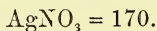
Hydrochloric acid does not act upon silver at ordinary temperatures; sulphuric acid only if it be concentrated and boiling; but nitric acid acts upon it when cold, and still more readily when hot.

*Test.*—To detect gold, copper, or lead in silver. Dissolve in nitric acid; any trace of gold is left untouched: add excess of ammonia, which should form a *colourless, clear* solution, but if Cu be present, a blue solution is obtained, and if Pb, a precipitate of oxide of lead remains undissolved.

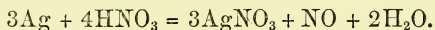
*In Pharmacy.*—Refined silver is used in the Pharmacopœia only for the preparation of pure nitrate of silver. A silver vessel is employed in boiling down Liquor Potassæ (or, Sodæ) in the preparation of Potassa (or, Soda) Caustica. Silver leaf is sometimes used for covering pills.

*In Medicine.*—Metallic silver is quite inert.

## ARGENTI NITRAS.



*Preparation.*—Dissolve refined silver in pure diluted nitric acid with the aid of gentle heat. Since silver is a monad, the equation is (see Acidum Nitricum):—



Any trace of gold, or of  $\text{Ag}_2\text{S}$ , which may be found in the metal is left undissolved as a black powder. Since most organic substances decompose this salt, contact with paper, tow, or other organic material must be carefully avoided. The salt, when carefully fused, and cast into proper silver moulds, yields the well-known sticks or rods of caustic often called *lunar caustic*.\*

\* Silver was called by the alchemists Diana, or Luna, from its supposed relationship with the moon.

*Characters and Tests.*—The flat rhomboidal crystals are sometimes of considerable size, and the well-defined character of the crystals is a good sign of its purity. Its taste is bitter and disagreeable. Nitrate of potassium is generally added to the rods or pencils to render them less brittle and to mitigate the caustic action, and they are sometimes coated with wax to preserve them from change. Like all neutral nitrates it is soluble in water. Its spirituous solution is decomposed after a time.

The characteristic *test* for silver in solution is the formation, with hydrochloric acid or any soluble chloride, of a white curdy precipitate ( $\text{AgCl}$ ), which darkens on exposure to light ( $\text{Ag}_2\text{Cl}$ ), is readily soluble in ammonia, and is insoluble in boiling nitric acid.

When heated strongly on charcoal it melts, and, like all nitrates, deflagrates, i. e. decomposes with explosion, leaving a dull, white crust of silver. If pure, 10 grs. precipitated with hydrochloric acid will yield 8.44 grs. of  $\text{AgCl}$ ; and the filtrate, when evaporated, should leave no fixed residue ( $\text{KCl}$ ). Nitrate of silver stains the skin or organic textures, such as linen, brown or black, especially under the influence of sunlight, and hence is used for *marking ink*. It also enters into most of the dyes in vogue for turning the hair black.

The stains may be removed from the skin or from articles of dress by a solution of cyanide of potassium, or by moistening with a solution of iodide of potassium, and then washing out with hyposulphite of sodium. Glass stoppers should always be used for the bottles in which lunar caustic is kept. Light, *per se*, causes no change in nitrate of silver; a solution of pure nitrate dissolved in distilled water in a clean bottle will remain clear for an indefinite time on exposure to light. A fragment of lunar caustic rolled up in paper and laid by in the dark, will, in time, be so thoroughly reduced, that a brilliant mass of metallic silver is alone left. The ordinary sticks of caustic are often greyish or dark on the surface from partial oxidation, or exhibit glistening specks of the pure metal.

*In Pharmacy.*—Oxide of silver is prepared by precipitation from the nitrate. Solutions of nitrate and of ammonio-nitrate of silver (App. II.) are used as tests for chlorides, and for arsenious, arsenic, and phosphoric acids. The volumetric solution (App. III.) is used especially in the estimation of hydrocyanic acid (Liebig), and in testing Spir. Rectif. for aldehyd.

*In Medicine.*—In overdoses, nitrate of silver acts as a corrosive poison; the proper antidote is, naturally, common salt, whereby insoluble AgCl is formed. Pieces of caustic have occasionally been left by accident in the vagina and urethra, and may similarly be rendered harmless by injections of salt.

*Internally.*—Nitrate of silver is chiefly used as an astringent, sedative, and nerve-tonic. In obstinate diarrhœa, especially the phthisical form, a pill of the nitrate, or a weak injection (gr. ss. to ʒi.) is a valuable remedy. Its sedative action is shown in the relief which it affords to the pain and vomiting of pyrosis, gastric ulcer, and malignant disease of stomach. In all these cases it is often advantageously combined with opium.

As a nerve-tonic, its value has been much praised in certain forms of epilepsy and in locomotor ataxy.

The main objection to a prolonged course, two or three months, of this medicine is the danger of producing a blueish or slate-coloured discoloration of the skin (*argyria*), which is seldom removable; but, in a few cases, the administration of iodide of potassium for syphilis subsequently has discharged the discoloration due to the previous use of nitrate of silver. The first certain indication of saturation of the system is the appearance of a dark purplish-blue line (Duguet) on the free edges of the gums, and blueish patches are also found inside the cheeks. Analogous deposits are to be seen in the alimentary canal, and even in the solid viscera, such as the liver and kidneys. Granular degeneration of the kidneys with albuminuria sometimes attends the continued use of this salt, and the Malpighian tufts are stained by deposits of the metal. (Liouville.) Nitrate of silver



is eliminated principally by the bowels, but a little escapes with the urine. (Cloeze.)

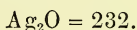
*Externally.*—Nitrate of silver is employed as a stimulant, astringent, and caustic. Vesication may arise, but it seldom causes a slough. It first whitens the skin, and then darkens it. As a caustic it is manageable, safe, and not too severe, and is used to destroy warts, fungous granulations, the surface of chancres and other ulcers. A very strong solution was recommended by Mr. Higginbottom in erysipelas, and superficial burns and scalds will heal kindly under the local application of lunar caustic. It is one of the best applications for purulent conjunctivitis, strumous ophthalmia, and is well suited for promoting the healing of indolent sores, and for arresting chronic purulent discharges from the auditory meatus, urethra, &c. In the case of ulcers of the cornea, caution is necessary lest a permanent brown stain be produced. A weak solution of sodic hyposulphite (gr. x. to  $\text{ʒi.}$ ) is said to be efficacious in partially removing this discoloration. Membranous sore throat, and, in particular, the common form of relaxed sore throat with yellow, cheesy specks in the tonsils, can be readily cured by a strong solution (40 grs. to  $\text{ʒi.}$ ) of the nitrate, or, better still, by the application of the fused stick. Inhalations of “atomised” nitrate of silver are often extremely useful in catarrhal laryngitis, and in incipient phthisis with laryngeal complication. Weak solutions are liable to cause much irritation in the larynx; strong solutions (40 to 60 grs. to  $\text{ʒi.}$ ) do not.

*Administration.*—Best given in pill, with mucilage, extracts, &c. It is unnecessary to avoid bread-crumbs as an excipient on account of its containing salt, because the nitrate will meet with chlorides, and other precipitants, the moment it enters the stomach. Nitrate of silver is precipitated by albumen, fibrin, or casein; the coagulum is soluble in excess of the salt, or of albumen, and also in chloride of sodium. The nitrate should not be prescribed in pill along with tannic acid, or both will be decom-

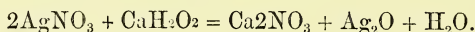
posed; metallic silver is set free, and gallic and carbonic acids are evolved, the latter causing the pills to swell up.

The average dose is  $\frac{1}{4}$  grain. Lotions are made of every possible variety of strength; a solution of the salt in Sp. Æth. Nitr. has the advantages of drying more rapidly, and of lying more evenly on the skin, the sebaceous secretion being dissolved. In the preparation of collyria, &c., pure distilled water is requisite, because the impurities (chlorides, sulphates, carbonates, &c.) in common water would at once decompose the salt.

### ARGENTI OXIDUM.



*Preparation.*—Add solution of nitrate of silver to lime water, and collect the precipitated oxide.



Liquor potassæ may be used instead of lime water, except that it is apt to contain carbonic acid.

*Characters and Tests.*—Like the oxides of mercury, gold, and platinum, argentic oxide, when heated, gives off all its oxygen, and leaves a residue of the metal; in this case, 93%. It should not effervesce with acids, showing the absence of carbonate of silver, either substituted for the oxide, or derived from the precipitant containing some carbonic acid.

It darkens in colour by keeping, and undergoes partial reduction. When rubbed with sulphur in a mortar, ignition takes place.

*In Pharmacy.*—Most organic substances, especially when moist, and particularly those containing sugar, honey, &c., decompose oxide of silver, and reduce the silver. Cresote or carboic acid are peculiarly unfit to prescribe along with oxide of silver, for much heat is developed, and even explosion sometimes follows. Pills containing oxide of silver, muriate of morphia, and extract of gentian have actually inflamed, and, in

one case a lady, who received such pills, put the pill-box inside her dress, and in three-quarters of an hour an alarming explosion occurred, her clothes were burnt, and her right breast severely scorched. (*Pharm. Jour.*, Mar., 1870.) Permanganate of potassium will sometimes react similarly.

*In Medicine.*—Its general effects are similar to those of the nitrate; but it is neither astringent nor caustic, and is asserted, but without reason, not to cause discoloration of the skin. It has been specially recommended in painful affections of the stomach; in menorrhagia, &c. Under its use the stools assume a dark colour. The usual dose is about one grain in pill.

### ARMORACIÆ\* RADIX.

*Origin.*—The vulgar name "*horse-radish*" is nothing but an epithet of size, and simply means the *large* radish; similarly "*horse-mint*," and "*bull-rush*."

The fresh root, the only part used, is the product of *Cochlearia Armoracia*, N. O. *Cruciferae*. The common scurvy-grass (*C. officinalis*) is another species of the same genus. The root should be dug up in autumn, as its pungency is then greatest.

*Characters.*—The root has been occasionally confounded with aconite root with fatal results; but a comparison of their characters will show the manifold differences between. Horse-radish root is larger, much longer, and odorous. The pungent volatile oil, on which its properties chiefly depend, does not exist pre-formed in the root; but, as in the case of mustard and bitter almond, is produced by the mutual reaction of two principles when the fresh root is bruised. The dried root yields no volatile oil when distilled with water alone; but if the myrosin of mustard be added, the oil will be developed. The oil is allied to volatile oil of mustard, contains sulphur, and appears to be sulpho-cyanate of butyl,  $C_4H_9CNS$ . It is heavier than

\* Armorica, in Brittany, whence it was derived.

water. When applied to the skin it will cause redness, and even vesication.

*In Medicine.*—It is stimulant and diuretic, and is esteemed to be an antiscorbutic. When chewed it acts as a powerful sialogogue, and in its general effects resembles mustard. It is chiefly used as an invigorating condiment.

### ARNICÆ RADIX.

*Origin.*—Arnica root is, strictly speaking, the *rhizome* (i. e. underground stem) and rootlets of *Arnica montana*, the Leopard's-bane, N. O. Compositæ. The flowers and leaves have been used in medicine, but are not now officinal.

*Characters.*—The peppery taste and peculiar aromatic odour distinguish this drug from all other roots or rhizomes with which it might be confounded, e. g. *Geum urbanum*. A bitter resinous principle, named arnicin ( $C_{20}H_{30}O_4$ ) has been obtained from it, as a golden-yellow amorphous solid. Trimethylamine is also procurable from it, as well as a yellowish volatile oil.

*In Medicine.*—The tincture diluted with water is in popular use as an external application in sprains and bruises, but Dr. Garrod has shown that a lotion of spirit and water is just as efficacious. Some mountaineers smoke it like tobacco, hence the name, *Tabac des Savoyards*. On the continent it is much used in various nervous affections, and there is no doubt that in over-doses it can act with considerable energy, inducing gastric pains, severe headache, and nervous disturbance, showing itself, in fact, a narcotico-acrid poison.

It has been especially valued in low and typhoid states of the system, and it is in great repute with homœopaths. The tincture may be given in ʒi. doses.

## ASSAFŒTIDA.\*

*Origin.*—This, the second of the fetid gum-resins, is the concrete juice of the living root of *Narthex Assafoetida*, N. O. Umbelliferae. At the proper season the summit of the root is cut off transversely, and the milky juice which exudes is scraped away. Successive layers are removed until the root ceases to yield. The hardened juice is packed in casks and cases which are sent by way of Bombay to Europe.

*Characters.*—When recent it is softish and moist but gradually becomes dry and hard. It occurs in large masses or in “tears,” but the tears, i. e. small ovoid portions, are seldom found separate. They somewhat resemble tears of ammoniacum from which, however, their odour readily distinguishes them. The change of colour of a freshly exposed surface from white to reddish, violet, or yellowish brown, is characteristic of assafoetida, and appears to result from the action of air and light on the resinous ingredient. The taste is not only bitter and nauseous, but persistent, and the stinking garlicky odour when once recognised is not easily forgotten. One of its synonyms is *Stercus diaboli*; yet in the East it was called *cibus deorum*. The odour depends upon the volatile oil which, like many other fetid oils, contains a large proportion of sulphur, and appears to be a mixture of sulphide of allyl,  $(C_3H_5)_2S$  and sulphide of hexyl,  $(C_6H_{11})_2S$ . Consequently, assafoetida pills will blacken silver leaf by forming a little sulphide of silver. It is difficult to remove the odour of assafoetida from any bottle or vessel in which it has been kept by repeated washings with water alone, but if a few drops of essential oil of almonds or of prussic acid are shaken up with the warm wash-water and allowed to stand for a while, and afterwards rinsed out thoroughly, all traces of the odour will be dispelled.

\* *Asa*, or *assa*, signifies gum in Persian; i. e. the fetid gum.

A crystallisable acid, *ferulic*, is obtained from assafoetida, but its chief ingredients are 3 to 5% of volatile oil, 25 to 30% of gum, and 50 to 70% of resin.

Hence, it is almost entirely soluble in rectified spirit; and this solvent is requisite in making Spir. Ammon. Fœt. and Tinct. Assafoetidæ. The tincture yields a *milk-white* precipitate of resin when diluted with water. Rubbed up with water alone, the gum-resin forms a smooth emulsion, e. g. Enema Assafoetidæ.

From the amount of resin and gum in the drug, it is not an easy matter to powder it, but pulverisation is much facilitated by triturating it with carbonate of ammonium, or by incorporating with it previously, while warm, from 4 to 10% of magnesia. It burns with a white flame evolving much smoke.

Assafoetida is often adulterated with inferior resins, dirt, sand, gypsum, flour, &c.

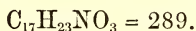
*In Medicine.*—Medicinally, it is the most powerful of the fetid gum resins. In Persia, India, and some adjacent countries, it is extensively used as a condiment to correct the flatulence arising from eating vegetables freely, and corresponds in this respect to the use of garlic in European countries. Children with hooping-cough are said sometimes to become fond of it.

In full doses it is aperient, and, as a stimulating injection, is a most efficient remedy in cases of excessive accumulation of air in the intestines, and especially in constipation attended with flatulent colic. United with resinous cathartics, or with aloes, it has an old-established reputation as an emmenagogue. As an antispasmodic in hysterical and functional nervous disorders, spasms, &c., it is in frequent use, and, on the whole, agrees in many of its properties with valerian; but is more useful than the latter in nervous affections of the respiratory organs and digestive canal. Evidences of its absorption are obtained from its disgusting odour, which pervades almost every secretion and excretion in the body, especially the perspiration, and it is even said to contaminate the pus of superficial ulcers.



The pilular form is the most eligible for administration, since all fluid preparations are so disagreeable in smell and taste. The full dose is 10 grains, but smaller quantities in repeated doses will often be preferable.

## ATROPIA.



*Origin.*—This alkaloid was discovered in 1831 by Mein. It exists not only in *Atropa Belladonna*, N. O. Solanaceæ, but also in the allied genus *Datura*. The so-called *daturia* of Stramonium is identical with atropia. English atropia is purer and more active than German atropia.

*Preparation.*—Belladonna root is percolated with rectified spirit which exhausts it of its native salt, acid malate of atropia, and of other soluble matters. The addition of lime to the tincture thus obtained, precipitates colouring substances, decomposes the malate, and sets the alkaloid free, which is converted into the soluble and more stable sulphate by dilute sulphuric acid. The filtered and concentrated solution is treated with carbonate of potash, which precipitates a yellowish resinous substance that interferes with the crystallisation of the atropia. After filtration the addition of excess of carbonate of potash precipitates the alkaloid itself. Then the alkaloid is dissolved out by chloroform, and finally decolorised by animal charcoal. Chloroform, as suggested by Rabourdin, is a peculiarly suitable solvent, for it takes up 33% of atropia.

*Characters and Tests.*—Atropia is soluble in 300 parts of water at 60°; in about 3 parts of chloroform; and in 25 to 30 parts of ether. From its sparing solubility in water, rect. sp. is necessary in the preparation of the Liquor. It is stated that  $\frac{1}{3000}$  gr. in solution will dilate the pupil.

*In Pharmacy.*—The strengths of its preparations correspond

with those of the other alkaloids, viz., *Liquor Atropiæ*, 4 gr. to ʒi.; and *Unguentum Atropiæ*, 8 grs. to ʒi.

The *Liquor Atropiæ* becomes mouldy by keeping. By prolonged contact with caustic fixed alkalies, atropia is rendered inert, and such a combination should be carefully avoided in practice.

*In Medicine.*—Since the effects of atropia upon the system are, in kind, precisely those of *Belladonna*, they will be treated of under that head.

### ATROPIÆ SULPHAS.

*Preparation.*—Carefully dissolve pure atropia in diluted sulphuric acid, and dry at a gentle heat.

*Characters and Tests.*—The advantage which this salt possesses over the free alkaloid is its ready solubility in water; hence its solution is less irritating to the eye than the spirituous *Liq. Atropiæ*. It occurs usually as a white powder, but can be obtained in needle-shaped crystals. It is known to be a sulphate, by giving with chloride of barium a white precipitate insoluble in acids. Unlike atropia, it is insoluble in chloroform.

The *Liquor* spoils by keeping, but, if prepared from pure sulphate of atropia and pure camphor water, it will retain its transparency for more than a year.

### AURANTII CORTEX.

### AURANTII FRUCTUS.

*Origin.*—The peel of the bitter or Seville orange, *Citrus Bigaradia*, N. O. *Aurantiaceæ*, is alone recognised in our *Pharmacopœia*, but in the U. S. code that of the sweet orange is also included. The *flowers* of both the bitter and sweet orange are officinal with us. (*Aqua Aur. Floris.*)

*Characters.*—The fruit is a large spheroidal berry, with a leathery rind (i. e. a *hesperidium*), and is divided into about nine

vertical cells containing from two to four seeds imbedded in an abundant pulp. The rind consists of two layers; the outer, thin and yellow, studded closely with vesicles filled with the fragrant oil (Portugal essence), the inner, thick, white, spongy, and inodorous. The white inner part is rejected because it is destitute of aroma, and is liable to become mouldy from its affinity for moisture. When the rind is dried it darkens in colour and loses much of its aroma, but retains its peculiar bitterness. The rind of the bitter orange is distinguished from that of the sweet by the oil-vesicles being concave in the former and convex in the latter.

The aromatic taste and odour depend upon the volatile oil, which resides exclusively in the superficial projecting cell-clusters. The volatile oil consists mainly of a hydrocarbon,  $C_{10}H_{16}$ , with a small quantity of oxidised hydrocarbons ( $C_{10}H_{10}O_5$  and  $C_{15}H_{10}O_5$ ), and is isomeric with oil of lemon. The floral-oil is termed *Oil of Neroli*. A crystalline neutral principle, *hesperidin*, also exists in the orange as well as in the lemon.

*In Pharmacy.*—The fresh peel of the bitter orange is used in the manufacture of Vinum Aurantii, from which are made Vin. Ferri Citr., and Vin. Quiniæ, and the Tinct. Aurantii Recentis is considered to possess a more agreeable flavour than that prepared from the dried peel. The tincture is a convenient vehicle for the administration of creasote.

*In Medicine.*—Bitter orange peel is a mild stomachic tonic, but its chief recommendation is as a flavouring adjunct to other medicines. Sometimes it serves to correct a nauseating tendency, e. g. cod-liver oil; or, it is added to assist the stimulant action of bitter tonics, e. g. Mist. Gent. and Tinct. Cinch. Co.

The small unripe oranges, dried, and turned in a lathe, are sometimes employed as issue-peas.

## BALSAMUM PERUVIANUM.

*Origin.*—Although long thought to be a product of Peru, it is exclusively derived from Central America, and is obtained from *Myroxylon Pereiræ*, N. O. Leguminosæ. Its specific botanical name is in honour of the late Dr. Pereira, who successfully investigated the true origin of the balsam in 1850. Previous to the collection of the balsam, the bark of the tree is bruised in part, the beaten bark is charred by fire, and removed after a few days. The juice which then exudes from the wood is received on cotton or woollen rags which are allowed to remain until saturated, On boiling the rags in water and allowing the liquid to stand, the water rises to the top and is poured off, and the balsam is put into gourds or bladders and finally exported in jars.

*Characters.*—It is one of the *true balsams*, i. e. fragrant resinous substances containing benzoic or cinnamic acid. The other true balsams are Balsam of Tolu, Benzoin, and Storax. The Canada and Copaiba balsams, so-called, are oleo-resins, and are destitute of either of these acids. The viscid liquid state of Peruvian balsam distinguishes it from all the other balsams, which are solid. Sp. gr. about 1.15. It is composed of 60 to 70% of volatile oil (cinnamein) to which it owes its odour, with about 23% of resins, and 6% of cinnamic acid. Contrary to what was formerly thought, little or no benzoic acid is found in it. The resin perhaps results from the action of moist oxygen on the oil, and increases in amount with age. The essential oil when fractionally distilled yields several distinct products, viz., benzoic alcohol, and the cinnamic and benzoic ethers of benzoic and cinnamic alcohol.

If it be adulterated with alcohol, or if a solution of Balsam of Tolu be substituted for it, there will be a diminution in volume when mixed with water. It is also said to be adulterated with castor oil and copaiba.

*In Pharmacy.*—No preparation of it is officinal. It is utilised in perfumery and in the preparation of chocolate, and in chemistry as the source of benzoic alcohol, of which it furnishes about 30%.

*In Medicine.*—It is generally ranked as a stimulating tonic and expectorant, but is seldom used internally. As an external application, a mixture of castor oil and Peruvian balsam makes a useful dressing for indolent, unhealthy ulcers, such as bedsores and broken chilblains. It is an agreeable and efficient remedy against the itch, and is occasionally used as a stimulant application to the scalp in alopecia.

If given internally it may be prescribed along with sugar and the yolk of an egg, or, with gum arabic.

## BALSAMUM TOLUTANUM.

*Origin.*—This, the second of the true balsams, is a concrete exudation from the stem of *Myroxylon Toluifera*, N. O. Leguminosæ. It issues forth on making incisions into the bark, and the liquid balsam as it exudes is received in vessels made of a black wax.

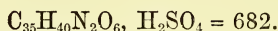
*Characters.*—It is a lustrous, brown or reddish solid, whose consistence varies with its age and with the temperature to which it is exposed. It possesses a warm and not disagreeable taste, and a fragrant, vanilla-like odour, due to the presence of a volatile oil. In its general composition it closely approaches Balsam of Peru, like which it contains cinnamic acid, and no benzoic acid. Old, hard Balsam of Tolu is a convenient source of cinnamic acid. Distilled with water some benzoic acid comes over, and a resin is left behind. Although soluble completely in spirit of wine (e. g. Tinct. Tolut.) and in chloroform, it is not dissolved by bisulphide of carbon.

*In Pharmacy.*—The Tincture, and the Tinct. Benz. Co. of

which it is an ingredient, both give an opaque yellow precipitate with water. Used in making the *Pilula Phosphori*.

*In Medicine.*—As a stimulating expectorant it ranks along with the other balsams, and the Syrup is sometimes prescribed in pectoral mixtures on account of its agreeable flavour; but it is too weak to be of any therapeutic efficacy. If the balsam be administered *per se* it is best dispensed in an emulsion made by triturating the drug with white sugar and mucilage and afterwards with water. Friar's balsam (Tr. Benz. Co.) is a popular and useful application to indolent sores, chapped nipples, &c.

### BEBERIÆ SULPHAS.



*Origin.*—The bark of the Bebeeru or Sipiri tree, *Nectandra Rodiæi*, N. O. Lauraceæ, contains an alkaloid (beberia) which has been shown to be identical with the principles, *buxin* of the box shrub, and *pelosin* of Pareira brava root. Bebeeru bark is also stated to contain two other alkaloids, viz., *siperia* and *nectandria*.

*Preparation.*—The method of extraction of this compound is not very important, but may be thus concisely explained. By means of acidulated water, the bark is exhausted of its soluble ingredients, including the beberia. The addition of a small quantity of milk of lime to the concentrated acid solution causes the separation of various inert matters, and, from the filtered liquor, the beberia is thrown down by ammonia. The alkaloid is then dissolved in rectified spirit, converted into sulphate by the cautious addition of dilute sulphuric acid, evaporated and dried at a moderate heat.

*Characters and Tests.*—None of the salts of beberia are crystallisable. Its solution in water is rendered more complete by



the addition of a few drops of dilute sulphuric acid. Being a sulphate, a solution of this salt precipitates with chloride of barium; and any soluble base, e. g. soda, precipitates the alkaloid, beberia, which should be soluble in ether. Pure beberia (buxin) is a white, spongy, amorphous powder; and its correct formula seems to be  $C_{18}H_{21}NO_3$ .

*In Medicine.*—See *Nectandræ Cortex*.

### BELÆ FRUCTUS.

*Origin.*—The *Ægle Marmelos*,\* or Bengal quince, N. O. Aurantiaceæ, is a rather large tree, which bears a fruit (berry) about the size of an orange, with a hard smooth rind. The *ripe* fruit is refrigerant, and is described as having a delicious flavour, and it is only when *half-ripe* that it possesses those qualities for which it is esteemed in practice.

*Characters.*—The reddish fragments of dried pulp and seeds with adherent rind are quite characteristic; and the only other medicinal fruit with which an *entire* bael fruit might possibly be confounded is *Colocynth*, but the pulp of this is white, spongy, and very bitter. The substitution of mangosteen fruit for bael has been indicated. The former is distinguished by its thickness, the absence of adhering pulp and seeds, and the presence of some of the pieces of dark, radiating, wedge-shaped stigmas.

*In Medicine.*—It is a mild astringent, and is used by practitioners in India in cases of diarrhœa and atonic dysentery. It is said to relieve these without inducing subsequent constipation.

The dose of the liquid aqueous extract (1 in 1) is from  $\mathfrak{z}\text{i}$ . to  $\mathfrak{z}\text{ij}$ .

\* From the specific name comes the term *Marmalade*, which was primarily applied to a preserve made from the fruit of this plant.

## BELLADONNÆ FOLIA.

## BELLADONNÆ RADIX.

*Origin.*—The Deadly Nightshade, or Dwale, *Atropa Belladonna*,\* N. O. Solanaceæ, although introduced by man into these islands from Europe, now maintains itself in apparently wild localities. It is rare in Ireland, and always occurs in shady places near ruins or houses. *Belladonna* is cultivated at Hitchin, and the men engaged in collecting the plants are said to be much affected in the eyes. Its activity is not impaired by cultivation.

*Characters.*—*Belladonna* is an herbaceous plant about three feet in height, presenting several round branching stems, to which are attached the dark green ovate leaves; the upper pairs being remarkably unequal in size. They are fetid when bruised. The flowers are pendent, about an inch in length, bell-shaped, of a dingy purple colour, arising from solitary peduncles in the axils of the leaves. The sombre colour of the leaves and flowers is common among the Solanaceæ, and gave rise to the ancient saying, *Hic niger est, hinc tu, Romane, caveto*. The fruit is a round berry, of a deep purplish-black when ripe, and rests upon a broad calyx. It contains numerous kidney-shaped seeds in two cells, with a violet-coloured juice. Since the leaves may be confounded with those of other plants, and as the berries have been eaten in mistake for wild cherries and for blackberries, it is important to be well acquainted with the external characters of the plant. In 1773, fourteen children were poisoned in France by eating these berries; and, at another time, 150 French soldiers fell victims to a similar mistake.

The parts directed for use are the fresh leaves and branches, the dried leaves, and the dried root, but all parts of the plant

\* *Bella donna*, from the use made of it by the Italian ladies to enhance their beauty.

are active. The leaves should be collected about June or July, and the root in the autumn or early spring, and from plants three years old or more. The leaves spoil by long keeping, and emit a small quantity of ammonia. Attention to the characters of the leaves, "ovate, acute, entire, smooth," will distinguish them from any of the adulterations that have been practised, such as *Digitalis purpurea* (Foxglove), *Solanum nigrum* (Woody nightshade), *S. Dulcamara* (Bittersweet), *Verbascum Thapsus* (Mullein), *Hyoscyamus niger* (Henbane), &c.

The root is white inside, having only a small cortical portion; but the best test is its physiological effect on the iris. It is considered to be stronger than the leaves. Mallow root has been substituted for belladonna root to the extent of 50%. The most important constituent of the plant is its alkaloid, atropia, which is in combination with malic acid, and exists in but small quantity. For example, 20 grs. have been obtained from 12 oz. of the root, i. e. about 0.3%. Possibly some is decomposed during the course of extraction.

*In Pharmacy.*—The root, being more active than the leaves, is employed in the preparation of Atropia, and of the Liniment; from the fresh leaves and branches the Succus is obtained; and from the dried leaves the Tincture.

*In Medicine.*—Generally, its action may be stated to be first stimulant, then hypnotic, narcotic, and anodyne.

Acceleration of the pulse, sometimes by as much as twenty-five beats, is the first symptom observed after the subcutaneous injection of atropia ( $\frac{1}{80}$  to  $\frac{1}{60}$  gr.); and the most obvious effects resulting from its continued use, even in moderate doses, are dryness and constriction of the back of the mouth and fauces, dilatation of the pupil, with hypermetropia and dimness of vision, and giddiness or perhaps slight delirium. There is often an increased desire to micturate; and dysuria, or more or less complete retention of urine for some time, invariably follows the action of a full medicinal dose. The urea of the urine is always increased, but more

especially the phosphates and sulphates; in fact it is a true diuretic. The outbreak of a scarlet rash on the skin such as described is of rare occurrence.

In larger quantities it is a most powerful poison. In addition to the exaggeration of the symptoms detailed above, we have great thirst, dysphagia, nausea, retching, and excitable delirium (hence its old name, *solanum furiosum*), passing into coma. The whole nervous system and the muscles of organic life are paralysed. No characteristic post-mortem appearances are found. Crum Brown and Fraser have shown that the methyl and ethyl derivatives of atropia have a much more decided paralysing action on the motor and sensory nerves, and act less as stimulants to the spinal cord than the natural alkaloid.

*Atropism*, i. e. the aggregate of the symptoms produced by the alkaloid, is especially marked by rapidity of evolution, by the predominance of delirium, and by the oculo-pupillary derangement. The treatment suitable in such an event is the immediate evacuation of the stomach by the stomach-pump, and by stimulating emetics, while ammonia, cold to the head, and the shocks of an induction apparatus, may be employed to rouse the torpid nervous system. Diluents should be freely supplied to favour the elimination of the atropia by the kidneys. As chemical antidotes, infusion of nutgalls (i. e. tannic acid), or tea and coffee, lime water, or alkaline solutions, may be serviceable; and although of late years it has been ascertained that, in some respects at least, the physiological antidote to belladonna is opium, yet Dr. J. Harley maintains that, excepting the effect on the pupil, all the other effects of atropia are intensified and prolonged by the action of morphia induced previously to or at any time during the operation of the former. Dr. T. Fraser has shown that calabar bean is the true physiological antidote of belladonna; and M. Costesè also concludes that *eseria* (the alkaloid of physostigma) is the positive antagonist of atropia. Belladonna acts on the horse and dog in much the same way as on man, although less

energetically; but some animals, e. g. rabbits, bear enormous doses of belladonna or of atropia with impunity. A rabbit may be fed for a month *exclusively* on fresh belladonna plant, and yet thrive vigorously on it. As a rule, herbivora are less easily affected than carnivora.

*Internally.*—Belladonna is strongly to be recommended in diseases of nervous irritation, but above all in painful affections of the nerves. There is, perhaps, no single remedy more effectual in neuralgia, especially of the pelvic organs. As an antispasmodic it has been strongly recommended in various forms of spasmodic cough, especially in whooping-cough and asthma, in which latter diseases it should be given in *full* doses, and frequently. Trousseau attached much importance to belladonna in the treatment of epilepsy, and as a laxative addition to purgatives in cases of simple constipation. Incontinence of urine in young people is often successfully met by full doses of the tincture, and in some cases of atonic constipation the stimulating influence of belladonna on unstriated muscles is often strikingly utilised. In cases also of paraplegia, depending upon a congestive or inflammatory state of the cord, belladonna is indicated, and has been successfully employed; while it is contra-indicated in anæmic cases.

There is no good evidence in favour of the reputed power of belladonna in preventing the invasion of scarlatina. The action of belladonna is modified by certain conditions which should be borne in mind :—

1°. Children are remarkably insusceptible to its cerebro-spinal effects. 2°. Weak and excitable temperaments are more readily and powerfully influenced than the strong. 3°. The effective energy of belladonna is inversely as the activity of the renal function; a free secretion of urine is attended with a less powerful action of the drug. 4°. Although atropia is decomposed when left for some time *in contact* with caustic alkalies, the simultaneous administration of potash, soda, ammonia, or lime water, does not interfere with the action of belladonna

or atropia. 5°. Acids have no particular influence in this direction.

*Externally.*—Pleurodynia, and tenderness of the chest in phthisis; lumbago, and neuralgic pains, are susceptible of much relief, and are often cured by the local application of belladonna. In ophthalmic practice atropia is very largely in demand, on account of its power in dilating the pupil\* and diminishing intra-ocular pressure. The best mode of so using it, is an aqueous solution of sulphate of atropia (4 gr. or 8 gr. to ℥i.) dropped into the eye; or, if preferred, one of the neat little squares of the medicated gelatin or paper proposed by Mr. Streatfield may be introduced into the inner canthus of the eye and retained there for a short time. A piece  $\frac{1}{3}$  of an inch square contains  $\frac{1}{250}$  gr. sulphate of atropia;  $\frac{1}{10}$  inch,  $\frac{1}{1000}$  gr. Severe local irritation occasionally ensues, and, in a few cases, poisoning has followed the use of atropia collyria, the alkaloid making its way into the system chiefly through the lachrymal passages, nose, and mouth.

When the extract is rubbed into the turgid breast it is found quickly to arrest the secretion of milk, and the attainment of this result will be favoured by the simultaneous administration of belladonna internally. Inflammations of other parts threatening to end in abscess are also well treated by the topical application of belladonna. The extract has been applied to the os uteri in cases of rigidity, and in chordee great relief is obtained by smearing it along the track of the urethra.

*Administration.*—The dose of the powdered leaves, for an adult, is 1 to 2 grs.; of the extract, *when good*,  $\frac{1}{4}$  to  $\frac{1}{2}$  gr.; of the tincture, 10 to 20 m., and of the succus, 10 m. A more effectual and elegant form for local application than the plaster

\* First proposed for this purpose by J. A. Reimarus, to whom the application was suggested by an accidental injection of the juice of belladonna into the eye.



is a mixture of seven parts of Linimentum Belladonnæ, with one part of Chloroform (Squire). The alkaloid, atropia, seems fully to represent the medical virtues of belladonna, and, in purity, certainty of effect, cleanliness, smallness of dose, and readiness of administration, it possesses many advantages over the Gale-nical preparations of belladonna. It may be given by the mouth in doses of  $\frac{1}{60}$  to  $\frac{1}{30}$  gr., but is more frequently injected under the skin; dose  $\frac{1}{80}$  to  $\frac{1}{60}$  gr. i. e.  $\frac{1}{10}$  the dose of morphia.

### BENZOINUM.\*

*Origin.*—Benzoin (not, of course, to be confounded with the liquid, benzine,  $C_6H_6$ ), or benjoin, sometimes improperly called *gum benjamin*, is the third officinal true balsam, i. e. an odorous resinous substance which contains either benzoic or cinnamic acid. It is derived from *Styrax Benzoin*, N. O. *Styracaceæ*, and, like most resinous bodies, it is prepared from the bark of the stem. When the tree is six years old incisions are made into the bark near the origin of the lower branches, and the juice which exudes hardens on exposure and forms the benzoin of commerce.

*Characters.*—Of the two kinds of benzoin met with, viz. :—that in agglutinated tears and that in brown masses, the former, or amygdaloid variety, is the most valuable, but some manufacturers of benzoic acid prefer the latter. In the inferior sorts, the white tears are few or entirely wanting. Sp. gr. 1·063 to 1·092. When heated it gives off thick irritating fumes, consisting chiefly of benzoic acid (see *Ac. Benzoicum*). Being a resin, it is soluble in alcohol, and is re-precipitated by water from the solution. Lime water and alkalies (liquor potassæ) partially dissolve it by forming soluble benzoates with its acid. Treated with strong sulphuric acid it assumes a

\* Arabic, *Benzoah*.

maroon-red colour, darkened by heat. It contains about 12% or 15% of benzoic acid, and nearly 80% of resinous matters. Cinnamic acid is sometimes present, and, in one specimen of Sumatra benzoin, Aschoff found cinnamic acid only, and *no benzoic acid*.

*In Pharmacy*.—It is (*a*) the source of benzoic acid, which is prepared by simple sublimation; (*b*) used to prevent rancidity in fatty matters, e. g. Adeps Benzoatus; (*c*) occurs in Tinct. Benz. Co. (Friar's balsam).

*In Medicine*.—Seldom used internally, although the inhalation of its vapour has been strongly recommended in chronic laryngitis. Since benzoin contains benzoic acid it must increase the quantity of hippuric acid in the urine. The Tincture is sometimes employed with benefit in cases of chronic bronchitis with copious secretion, but is more recommended as an external hæmostatic, and as an application to indolent and unhealthy sores. An excellent liniment for ulcerated bed-sores, &c., is a mixture of castor oil (ʒi.) and Friar's balsam (ʒi. to ʒiij.) Benzoin enters into the composition of pastilles for fumigation.

## BISMUTHUM.\*

### BISMUTHUM PURIFICATUM.

Bi = 210.

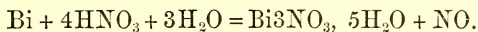
*Origin*.—Bismuth, which was long confounded with other metals, viz., antimony, tin, and lead, is chiefly derived from Saxony, and occurs usually in the native state, or, it may be extracted from its ores by fusion.

As met with in commerce it is generally impure, and is liable to contain arsenic, iron, or copper, &c.

\* From *Wismuth*, Germ.

*Purification.*—To remove these impurities the crude bismuth is fused twice with  $\frac{1}{10}$  of its weight of nitre, by which means most of the arsenic and copper are oxidised and removed in the form of slag from the melted bismuth, which fuses at  $507^{\circ}$  F. This process is wasteful, and does not remove the impurities thoroughly.

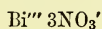
*Characters and Tests.*—Bismuth may be obtained in beautiful masses of iridescent cubical crystals, and always, even in mass, has a distinctly pinkish tinge. Dissolved in nitric acid it forms a *neutral* nitrate, which can be obtained in crystals by evaporation.



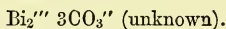
But if these crystals are dropped into water they are decomposed, like most bismuth salts, a white precipitate of *basic* salt,  $\text{BiONO}_3 \cdot \text{H}_2\text{O}$  (or,  $\text{BiNO}_4$ ) falls down, and a super-acid salt remains in solution. (See Bism. Subnitr.) Iron or copper, if present, would also remain in solution, and, on addition of carbonate of ammonia, iron would be indicated by a brownish precipitate ( $\text{Fe}_2\text{O}_3$ ), and copper, by a blue solution being obtained. All soluble salts in which bismuth acts as the electro-positive element, are decomposed by water as above. The basic precipitates are distinguished from the analogous antimonial precipitates by being *insoluble* in tartaric acid.

*Chemical relations.*—Although commonly regarded as a metal, bismuth approaches nitrogen and phosphorus in its chemical characters, and accordingly it is now, along with antimony and arsenic, usually reckoned among the metalloids. Hence, it belongs to the class of pentads, although, as a rule, it is trivalent, e. g.  $\text{BiCl}_3$ . The formulæ of the officinal bismuth salts are anomalous, since they represent basic and not neutral compounds, and they may all be viewed as normal bismuthic salts with the acid radical more or less replaced by basic dyad oxygen; thus,

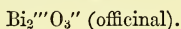
Normal nitrate.



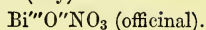
Normal carbonate.



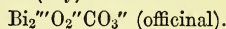
Normal oxide.



Sub (oxy) nitrate.



Sub (oxy) carbonate.



That is, one atom of oxygen in the nitrate replaces  $2\text{NO}_3'$ ; and, in the carbonate, 2 atoms of oxygen replace  $2\text{CO}_3''$ .

*In Pharmacy.*—Bismuth is used for the preparation of three salts only : (1) Carbonate ; (2) Subnitrate ; (3) Ammonio-citrate, and from the subnitrate is prepared the oxide. It is a constituent of some kinds of type-metal and of pewter-solder, and, like antimony, possesses the singular property of *expanding* on cooling.

*In Medicine.*—Not used in the uncombined state.

## BISMUTHI ET AMMONIÆ CITRATIS LIQUOR.

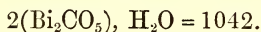
*Preparation.*—To solution of neutral nitrate of bismuth add citric acid and then solution of ammonia, until the precipitate at first formed is redissolved, and the solution is neutral or slightly alkaline.

*Characters and Tests.*—The solution contains citrate of bismuth dissolved in citrate and nitrate of ammonium. When heated with potash it, of course, evolves ammonia, and yields a white precipitate of hydrate of bismuth. Treated with hydrochloric acid, oxide of bismuth is at first precipitated owing to neutralisation of the ammonia, and is finally dissolved as chloride by an excess of the acid. With sulphuretted hydrogen a black precipitate ( $\text{Bi}_2\text{S}_3$ ) is formed, and the amount of bismuth in the solution can be found by collecting and weighing this precipitate.

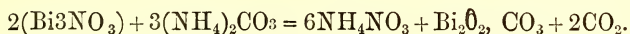
*In Medicine.*—Introduced as the representative of “Schacht’s Liquor Bismuthi,” a preparation suggested by a chemist of that name in Clifton.

It is a convenient form for giving bismuth in solution, is perfectly miscible with water, and is compatible with most sedatives and anodynes, and with the tonic infusions. Its effects are similar to those of Bismuthi Subnitrates, and the dose is ʒss. to ʒi.

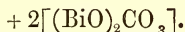
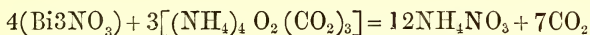
### BISMUTHI CARBONAS.



*Preparation.*—(a) Prepare normal nitrate by dissolving bismuth in nitric acid; (b) add the concentrated solution of the nitrate to an excess of carbonate of ammonia in the cold. A white precipitate of hydrated oxy-carbonate falls down.



Or, using the formula of the carbonate of ammonia in the Pharmacopœia,



(Tilden).

Wash and dry the precipitate at a gentle heat, to avoid decomposition.

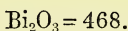
*Characters and Tests.*—Sulphuretted hydrogen blackens it ( $\text{Bi}_2\text{S}_3$ ), and this black sulphide, unlike the sulphides of tin, antimony, and arsenic, is insoluble in sulphide of ammonium. It is insoluble in water, as are all neutral and basic carbonates, except those of the alkalies. It is evidenced to be a carbonate by dissolving with effervescence in acids, and it is distinguished from the nitrate by its sulphuric acid solution not bleaching indigo solution. The nitric acid solution when *freely* diluted gives a white precipitate of subnitrate, and it should give no

precipitate with sulphuric acid, whereby it is distinguished from carbonate of lead (white lead), nor with nitrate of silver, showing absence of chlorides.

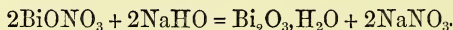
*In Medicine.*—Its therapeutical action accords in the main with that of the subnitrate, but, being antacid and more soluble in the gastric juice, it sometimes agrees with the stomach better.

10 grs. is an average dose, in powder, bolus, or, suspended in milk.

### BISMUTHI OXIDUM.



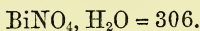
*Preparation.*—Boil basic nitrate of bismuth with excess of solution of soda, decant, and wash the precipitated oxide.



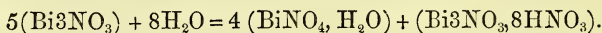
*Characters and Tests.*—A yellow powder known to be free from undecomposed nitrate by not losing weight when heated to redness. The other tests are explained under Bismuthi Subnitrates, and in the general characters of the bismuth salts.

*In Medicine.*—Its therapeutical properties are the same as those of the subnitrate, and it may be given in similar doses. It is a definite compound, and usually free from impurities.

### BISMUTHI SUBNITRAS.



*Preparation.*—(a) Obtain the neutral nitrate by dissolving bismuth in nitric acid :  $-\text{Bi} + 4\text{HNO}_3 = \text{BiNO}_3 + \text{NO} + 2\text{H}_2\text{O}$ ; heat to expel the nitric oxide, and (b) pour the concentrated solution into a large quantity of water; the subnitrate precipitates and a supernitrate remains in solution.





The soluble super-nitrate is removed by decantation. Wash and dry the precipitate at a gentle heat, so as to avoid any decomposition.

*Characters and Tests.*—Although usually white, it becomes greyish on exposure to light in contact with organic matter. Like all bismuth salts it is blackened by sulphuretted hydrogen ( $\text{Bi}_2\text{S}_3$ ). It is the only officinal nitrate *insoluble* in water, but is readily soluble in nitric acid without effervescence, forming a neutral nitrate, which is again decomposed when poured into water. If treated with sulphuric acid, nitric acid is liberated, which blackens sulphate of iron; this is characteristic of nitrates. The absence of lead and of chlorides is shown by the nitric acid solution giving no precipitate with sulphuric acid and nitrate of silver respectively. The subnitrate of commerce is generally tolerably pure, but occasionally it is adulterated with phosphate of lime to a considerable extent.

*In Pharmacy.*—Is a constituent of the Bismuth Lozenges, and from it the Oxide of Bismuth is obtained. If a concentrated solution of iodide of potassium be added to this salt, a dark red precipitate of iodide of bismuth is formed; with a dilute solution a yellowish precipitate.

*In Medicine.*—In large doses it is said to be an irritant poison, but, in fatal cases, it is probable either that arsenic was present as an impurity, or that the caustic ternitrate was administered instead. The subnitrate has been taken to the extent of 2 oz. *per diem* without the slightest inconvenience. According to Dr. Brinton, its continuous administration causes a blueish-red line along the edge of the gums, analogous to but wider and redder than that resulting from the use of lead. It is chiefly used as a gastric sedative and astringent, and is much employed in painful affections of the stomach, e. g., pyrosis, irritable dyspepsia, and ulcer. In chronic diarrhœa and gastro-intestinal irritation, it is often useful, associated with a little opium. The stools are blackened under its use from formation of sulphide of bismuth.

Bismuth is chiefly or altogether eliminated with the *faeces*. Occasionally applied externally to freely discharging ulcers, or to acute eczema, &c., and its use is unattended with pain. The average dose for an adult is 10 grs. in pills, powder, or suspended with mucilage in water, or in milk. Or, the lozenges, 2 grs. in each, may be prescribed.

### BORACIC ACID (APP. I.)

Only two compounds of Boron occur in the Pharmacopœia, viz.:—Boracic acid, and a borate of sodium, called Borax. Boron, B, is triatomic.

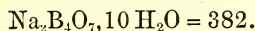
*Origin.*—Boracic acid is found free in the jets of steam (fumaroles) which arise from fissures in the ground in certain volcanic parts of Tuscany, and it collects in the water of the lagoons formed round the mouths of these orifices. The aqueous solution is concentrated, and, on cooling, the boracic acid crystallises out.

*Characters.*—White, shining crystals, very sparingly soluble in water, soluble in alcohol, and tinging its flame green. The formula of artificial boracic acid, as prepared by acidulating a hot solution of borax, is  $\text{H}_3\text{BO}_3$ , but, since this body loses one molecule of water at  $212^\circ$ , the formula of the volcanic acid is  $\text{HBO}_2$ , (metaboracic acid), i. e. it is the first anhydride of the normal acid. At a red heat a second molecule of water is expelled, and the second or ultimate boric anhydride is left,  $2\text{HBO}_2 - \text{H}_2\text{O} = \text{B}_2\text{O}_3$ .

*In Pharmacy.*—Borax may be obtained from it. A spirituous solution of boracic acid, App. II. (50 grs. to  $\text{ʒi.}$ ), is used for the detection of turmeric as an adulterant of rhubarb. (See *Rhei Radix*.) Boracic acid possesses the peculiar property of turning turmeric brownish-red similarly to alkalies. Turmeric paper stained with boracic acid becomes blue on moistening it with a weak solution of potash.

It is not used in Medicine.

## BORAX.\*



*Origin.*—Found native abundantly in certain lakes in Thibet and Persia, from which it is obtained by spontaneous evaporation, in the form of *tincal*, or crude borax, which must be refined before being used in medicine or the arts. There is a lake in California the mud of which for the space of three hundred acres contains large quantities of borax both in the crystallised and diffused condition. Artificially, it is largely prepared by neutralising native boracic acid with carbonate of soda at the boiling temperature. On standing, the borax crystallises out.

*Characters and Tests.*—Its formula is peculiar, and its probable real constitution is  $2(\text{NaBO}_2)$ ,  $\text{B}_2\text{O}_3$ ,  $10\text{H}_2\text{O}$ , i. e. metaborate of sodium, boracic anhydride, and water of crystallisation, or perhaps,  $2(\text{NaBO}_2, \text{HBO}_2)$ ,  $9\text{H}_2\text{O}$ . The old name, biborate of soda, is certainly incorrect. The crystals effloresce slowly on exposure to the air, and become covered with a white powder. It is sparingly soluble in cold water, about 1 in 30, but is dissolved by two parts of boiling water, and one of glycerin. It is rendered more soluble in water when mixed with cream of tartar, and the mixture has the singular property of inspissating a solution of gum Arabic, salep, or Iceland moss; two or three grs. of it are enough to convert half an ounce of gum mucilage into an elastic mass, which, however, may be liquefied again on the addition of honey or sugar to the mixture. (Stillé).

When heated, it undergoes aqueous fusion and loses half its weight, and at a red heat forms a transparent glass, much used as a *flux* for mineral substances in blow-pipe and chemical operations: fused borax readily dissolves many metallic oxides.

\* From *Baurac*, Arab., a species of nitre.

On account of the sparing solubility of boracic acid, a hot saturated solution of borax, acidulated with any soluble acid, e. g. sulphuric, deposits boracic acid ( $\text{H}_3\text{BO}_3$ ) as it cools.  $\text{Na}_2\text{B}_4\text{O}_7 + \text{H}_2\text{SO}_4 + 5\text{H}_2\text{O} = \text{Na}_2\text{SO}_4 + 4\text{H}_3\text{BO}_3$ . Being an alkaline salt, its purity is estimated by neutralising a given weight of it with the standard solution of oxalic acid. 191 grs. (i. e. half a molecule, = one atom of sodium, or, one molecule of  $\text{NaHO}$ ) should exactly neutralise 1000 gr. measures of oxalic acid solution (which contain half a molecule of oxalic acid,  $\text{H}_2\text{C}_2\text{O}_4$ ).

*In Pharmacy.*—Being very soluble in glycerin, a solution of it has been introduced (Glyc. Boracis) containing one in six by weight. The Mel Boracis, a mixture of honey and borax, is an older preparation.

*In Medicine.*—Borax appears to act as a diuretic, and like other alkaline remedies, is useful as a sedative to the gastrointestinal tract. But it is chiefly used externally as a mild astringent and stimulant in herpetic and aphthous affections of the mouth, in mercurial salivation, cracked tongue, fissured nipples, &c., and in some scaly skin affections, and as a remedy for itching of the skin, for which latter purpose hydrocyanic acid may be conjoined with it. It has been criminally used to procure abortion, and has been proposed as an emmenagogue. It has been detected in the urine, and seems to pass out of the system unchanged.

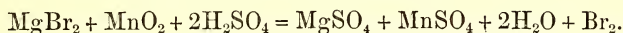
## BROMUM.\*

Br = 80.

*Origin.*—The chief source of bromine is bromide of magnesium, which is found in sea-water and in certain saline springs, e. g. Ashby in Leicester, and Kreuznach in Prussia. It also exists in

\*  $\text{Br}\tilde{\omega}\mu\omicron\varsigma$ , a stench.

many marine plants, and in molluscos animals. It may be liberated from its compounds in the same manner as the other halogens, Cl and I, are from their salts, viz., by heating with sulphuric acid and black oxide of manganese.



The discovery of bromine is due to Balard in 1826. It must be kept under a layer of water, and in a stoppered bottle, for it is very volatile, and its vapour corrodes cork.

*Characters and Tests.*—Bromine is the only liquid non-metallic element, and it emits an irritating and very fetid vapour. With water it forms a crystalline hydrate at  $32^\circ$ . Pure bromine can be frozen. Its true boiling point is  $145^\circ\cdot4$  (Pierre), and not  $117^\circ$  F. as stated in the Pharmacopœia. When mixed with an alkali (potash or soda) it is at once decolorised, owing to the formation of colourless compounds, bromide and bromate of sodium,  $6\text{NaHO} + \text{Br}_6 = 5\text{NaBr} + \text{NaBrO}_3 + 3\text{H}_2\text{O}$ . A similar reaction occurs with Cl or I. Like chlorine, bromine possesses bleaching properties only in the presence of water. The presence of iodine in bromine is detected (B. P.) by adding a trace of bromine in excess to the alkaline solution; the iodine is thus set free, and can then be tested for by starch. But this test is fallacious, because the iodine, on account of its higher electro-positive quality, would be partially, if not wholly, converted into iodate of sodium which is not decomposable by bromine. The atom of bromine, like that of the other halogens, Cl, I, and F, is monatomic. Its general affinities are similar to those of Cl, but it is less electro-negative, and therefore, although its affinity for hydrogen and metals is weaker, it combines with oxygen with greater energy.

*In Pharmacy.*—Used in the preparation of the two alkaline bromides, Ammonii Bromidum and Potassii Bromidum. The solution of bromine (App. II.), m. ij. to  $\text{ʒi.}$ , serves as a test to detect iodine in the bromides.

*In Medicine.*—Seldom used internally; but it has been em-

ployed as a deodoriser and disinfectant in hospitals, and a lotion of it is recommended for gangrenous sores. In an overdose, bromine is an irritant poison.

### BUCHU\* FOLIA.

*Origin.*—Buchu, or Bucco, consists of the dried leaves of three species of the shrubby genus, *Barosma*,† N. O. Rutaceæ, which are common in a limited district near the Cape of Good Hope. The Hottentots collect these leaves and rub them, in the state of powder, upon their greasy bodies on account of their odour.

*Characters.*—Like all the Rutaceæ, the leaves are marked with clear dots, i. e. collections of oil-cells, readily seen by holding the leaf across the light. These oil-cells are best seen on the under surface, and at the margins of the leaf. The powerful odour, somewhat like that of peppermint, is due to the presence of a light, brownish-yellow, volatile oil, which exists in small quantity, from 0·6 to 1·2%. Of the three species of buchu, viz., “short buchu” (*Barosma betulina*‡), with *obovate* leaves; “medium buchu” (*B. crenulata*), with *oval-lanceolate* leaves; and “long buchu” (*B. serratifolia*), with *linear-lanceolate* leaves; the first is superior, as it yields the largest amount of volatile oil, and it and *B. serratifolia* are the most abundant sorts in commerce. The leaves of *B. betulina* resemble those of box in shape, and the two other species those of senna; but neither senna nor box leaves have their edges indented or serrated. Portions of the stalks and fruit are often mixed up with the leaves.

*In Medicine.*—Long in use among the Hottentots, and with us, as with them, it is chiefly employed as a stimulant diuretic in certain urinary complaints, e. g. chronic catarrh of the bladder,

\* A Hottentot name.

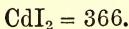
† Βαρύς, heavy; ὀσμή, a smell.

‡ *Betula*, a birch tree, from the shape of the leaves.



enlarged prostate, &c. It yields its sensible properties to water and spirit, hence it is administered either in Infusion or Tincture, one to two ounces of the former, and ʒss. to ʒi. of the latter.

### CADMII IODIDUM.



*Origin.*—The chief source of metallic cadmium\* is as an occasional constituent of zinc ores, from which it is separated by distillation, cadmium being more volatile than zinc. Cadmium is a white metal resembling tin, and, like that metal, crackles when bent. Sp. gr. 8.6. By digesting cadmium with a little iodine and water until the colour of the iodine disappears, a solution of iodide of cadmium is obtained, which deposits pearly micaceous crystals on evaporation. Another method is to decompose sulphate of cadmium by iodide of barium; filter from precipitated sulphate of barium, and evaporate the solution.

The atom of cadmium is biatomic,  $\text{Cd}''$ .

*Characters and Tests.*—This brilliant salt keeps well under ordinary circumstances, but, if heated to a dull red heat, it is decomposed and gives off violet vapours of iodine. In most of its chemical relations cadmium resembles zinc, but is distinguished from it by giving (a) with sulphuretted hydrogen, a *yellow*† precipitate of  $\text{CdS}$ , *insoluble* in alkalies or dilute acids; and (b) with potash, a white gelatinous precipitate,  $\text{Cd}_2\text{HO}$ , *insoluble in excess* of the reagent. If zinc were present its oxide would be re-dissolved by the potash, and it could then be detected in the filtrate from the cadmium, by sulphide of ammonium causing a *white* precipitate ( $\text{ZnS}$ ). The purity of cadmic iodide is estimated by precipitating it with nitrate of silver, and weigh-

\* *Cadmia*, tutty, in which it was first observed.

† The three other *yellow* sulphides are,  $\text{As}_2\text{S}_3$ ,  $\text{As}_2\text{S}_5$ , and  $\text{SnS}_2$ ; these are all soluble in alkalies.

ing the insoluble iodide of silver; 10 grs.  $\text{CdI}_2$  should yield 12.5 grs. of  $\text{AgI}$ .

*In Medicine.*—Introduced by Dr. Garrod as a substitute for the analogous preparation of lead, which is yellow, stains the skin, and might possibly prove injurious by absorption. The ointment, which keeps well, has been found efficient in the treatment of scrofulous and other glandular enlargements, nodes, and chronic inflammations of joints. This salt is not given internally.

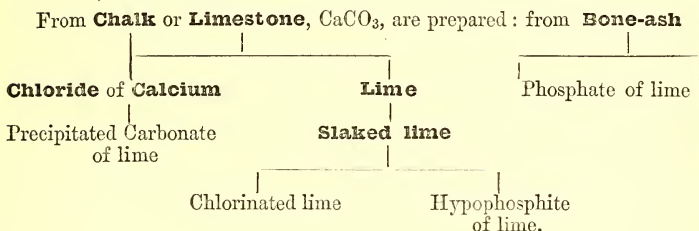
### CALCIUM.

$\text{Ca} = 40.$

Calcium, a yellowish malleable metal, is the basic radical of lime and all its compounds. In nature it occurs abundantly, as carbonate in chalk, limestone, marble, and calc-spar; as sulphate, in gypsum and alabaster; as silicate in many minerals; as fluoride in fluor-spar; and, chiefly as phosphate and carbonate, in the bones and shells of animals. The atom of calcium is biatomic,  $\text{Ca}''$ , as is seen in the subjoined table of the formulæ of all the officinal calcium salts.

1. Calx.	$\text{CaO}.$	
2. Calcis Hydras.	$\text{CaO}, \text{H}_2\text{O}.$	
Liquor Calcis.	.	0.56 gr. to $\text{℥i}$ .
" "	Saccharatus .	7.11 grs. to $\text{℥i}$ .
3. Calcii Chloridum.	$\text{CaCl}_2.$	
4. Calx Chlorata.	$\text{CaOCl}_2.$	
5. Calcis Carb. Præcip.	$\text{CaCO}_3.$	
6. Creta.	$\text{CaCO}_3.$	
Creta Præparata.		
Marmor Album.		
7. Calcis Hypophosphis.	$\text{Ca}_2\text{PH}_2\text{O}_2.$	
8. Calcis Phosphas.	$\text{Ca}_3\text{PO}_4.$	
Os Ustum.		
9. Calcis Sulphas.	$\text{CaSO}_4.$	(Solution, App. II.)
Plaster of Paris.	App. I.)	

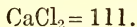
## GENEALOGICAL TABLE OF THE CALCIUM COMPOUNDS.



The chief *test* for the detection of calcium is the formation of a white precipitate with oxalate of ammonium, insoluble in acetic acid (which dissolves calcic phosphate), but soluble in hydrochloric or nitric acid.

Among the chief *physiological* and *therapeutical* actions of the calcium compounds we may reckon their antacid and astringent qualities, and, since lime salts are essential to the structure of bone, they may, in certain cases, be considered as directly serving nutrition. Lime is a necessary constituent of the body, not only of its hard tissues, but also of its soft structures, muscles, and nerves, and wherever active growth is going on there lime salts are requisite.

### CALCII CHLORIDUM.



*Preparation.*—Neutralise hydrochloric acid with chalk or marble :— $2\text{HCl} + \text{CaCO}_3 = \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ .

Evaporate the solution to dryness and strongly heat the residue; solid anhydrous chloride of calcium remains. Carbonate of lime often contains carbonate of iron; this is removed by peroxidising it with chlorinated lime, and precipitating ferric oxide

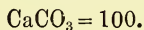
by slaked lime. Any magnesia present would be got rid of at the same time.

*Characters and Tests.*—It can be obtained in prismatic crystals, but, in the fused state, as officinal, it is anhydrous and non-crystalline. Distinguished from Calx Chlorata (chloride of lime) by not evolving chlorine or hypochlorous acid on the addition of hydrochloric acid. The absence of any trace of iron or of magnesian chloride is shown by its yielding no precipitate with lime water.

*In Pharmacy.*—On account of its avidity for water the fused salt is much used for drying gases (e. g., hydrogen, in preparing Ferrum Redactum), and for removing water from solids and liquids. An aqueous solution, 1 in 10 (App. II.), is used as a test for Pot. Citras; and a saturated solution, four parts in five of water (App. II.), is used to determine the strength of Spir. Ætheris Nitr. Chloride of calcium is further employed in the preparation of Acid. Tartar., Calc. Carb. Præcip., and Morph. Hydrochl., and in the purification of Æther and Chloroform.

*In Medicine.*—Seldom used now, but has been specially recommended in scrofulous and tuberculous diseases, and for the removal of glandular tumours. It occurs in many mineral waters, and in medicinal action it resembles chloride of barium. In excessive doses it is an irritant, and even a fatal poison. The dose of the solid salt is about 10 grs., and of the weaker "solution" about 3 ss., given in milk or sweetened water, as it possesses a disagreeable acrid taste. In prescribing, care should be taken not to confound it with the chloride of lime, a totally different substance.

### CALCIS CARBONAS PRÆCIPITATA.



Carbonate of lime occurs in the Pharmacopœia under three heads, viz., Calcis Carb. Præcip., Creta, and Marmor Album.

Oyster shells (testæ præparatæ) were formerly employed, as well as crabs' claws, crabs' eyes, so-called, and coral.

*Preparation.*—To solution of chloride of calcium add excess of solution of carbonate of soda, at the boiling temperature :— $\text{CaCl}_2 + \text{Na}_2\text{CO}_3 = \text{CaCO}_3 + 2\text{NaCl}$ . Wash the precipitate with hot water until all the common salt (NaCl) is washed away, as shown by the nitrate of silver test.

*Characters and Tests.*—A pure form of carbonate of lime. Like most carbonates, it is insoluble in water, but wholly soluble in dilute acids, with copious effervescence, and thus distinguished from sulphate of lime, which has been sold for it. That it is a calcium salt is evidenced by the neutral nitric acid solution giving an abundant white precipitate with oxalate of ammonia, while the absence of phosphates and chlorides is shown by the solution giving no precipitate with saccharated solution of lime or nitrate of silver respectively.

*In Pharmacy.*—Used only in the preparation of Bismuth Lozenges.

*In Medicine.*—Its uses are the same as those of Creta Præparata, over which it possesses no advantage worth considering.

### CRETA.\*

*Source.*—Occurs abundantly in nature in the south of England and north of France. Chalk beds frequently contain nodules of flint.

*Characters.*—Chalk is never quite pure, but contains, besides gritty siliceous particles, traces of aluminum and iron.

*In Pharmacy.*—May be used for generating carbonic acid gas, by the action of hydrochloric or nitric acid upon it.

*In Medicine.*—On account of its grittiness, not employed until

\* From the island Crete, whence the best chalk was derived. Creta and Marmor are more conveniently considered here than in their strictly alphabetical order.

it has been reduced to the prepared form: The term *chalk stones* is commonly applied to gouty concretions, but they really consist of acid lithate of sodium.

### CRETA PRÆPARATA.

*Preparation.*—The process consists of two steps. (a) Rub up the chalk, in fine powder, with a little water to the consistence of cream (*levigation*). (b) Agitate the creamy mixture with a large quantity of water, let it stand, decant from the heavier particles, and allow the milky liquid to deposit its sediment of chalk (*elutriation*).

*Characters and Tests.*—Usually occurs in small conical masses, which are formed by forcing a cream of chalk and water through the neck of a funnel. The tests for its purity have been already explained under Calcis Carb. Præcip. If carefully prepared it will be pure; and it is minutely crystalline, and not amorphous as the Pharmacopœia states.

*In Pharmacy.*—Used in the preparation of Citric and Tartaric acids. Triturated with mercury, the well-known *grey powder* (Hyd. c. Creta) is obtained, the metallic globules become invisible even to a lens, and the mercury is said to be “killed” or “extinguished.” Suspended in cinnamon water by means of gum and sugar it forms chalk mixture (Mistura Cretæ).

*In Medicine.*—An excellent antacid and mild astringent, and is well adapted to diarrhœa and gastric affections, accompanied with acidity, e. g. in young children, and in gouty dyspepsia. It is constantly employed in summer diarrhœa, in combination with some astringent tincture, and with or without opium. If too long continued it might possibly accumulate, and so lead to intestinal concretions. Externally it is dusted over burns, acute eczema, and other irritable conditions of the skin, and, in the form of *whiting*, is sometimes painted over irritable sores, e. g. burns of the second or third degree. Chalk ointment is an admirable



dressing for an ulcerated blistered surface. In cases of poisoning by oxalic or sulphuric acid it furnishes the appropriate antidote. It is most frequently given in the form of chalk mixture, dose  $\mathfrak{z}\text{i.}$  to  $\mathfrak{z}\text{ij.}$ , and the two compound chalk powders are peculiarly serviceable for administration to children. The Pulv. Cretæ Arom.  $\bar{c}$ . Opio contains 1 in 40 of opium.

### MARMOR ALBUM.

Granular white marble is only used as a source of carbonic acid gas for the conversion of neutral carbonates into acid carbonates (Pot. Bicarb.; Sodæ Bicarb.) The purest kind of marble is that from Carrara. An effervescing solution of carbonate of lime in water saturated with carbonic acid gas is sold under the name of *Carrara water*.

### CALX.\*

CaO = 56.

*Preparation.*—Heat its carbonate (chalk, or limestone) to full redness.  $\text{CaCO}_3 = \text{CaO} + \text{CO}_2$ .

Pure lime is obtained by heating calc-spar or Carrara marble. Lime has been long known, but its true nature was first pointed out by Black, in 1755.

*Characters and Tests.*—Lime is a greyish-white solid: sp. gr. 2.3, and it possesses a strong, caustic, alkaline taste. With three-fourths of its weight of water quicklime immediately swells up and crumbles. It also disengages a great amount of heat, as much as 500° F., and is transformed into hydrate of calcium (slaked lime),  $\text{CaO}, \text{H}_2\text{O}$ , or  $\text{CaH}_2\text{O}_2$ . The resulting hydrate is perfectly dry, and lime can thus solidify 31% of its weight of water. Although it has such an affinity for a certain amount of

\* Arabic, *Kalah*, to burn. Formerly applied to any metallic rust, and to the residue of the combustion of any substance; hence the term *calcination*. Calx is more naturally treated of before Calcis Hydras.

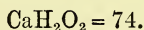
water, yet the hydrate is only very sparingly soluble, and it is *less soluble* in hot than cold water. At  $32^{\circ}$  water takes up twice as much lime as at  $212^{\circ}$ . At  $60^{\circ}$  its solubility is about  $\frac{1}{2}$  gr. to  $\frac{3}{4}$  i. (Liquor Calcis.) Sugar increases the solubility of lime in water (Liq. Calc. Sacchar.); so also glycerin (Carles). Lime is infusible at the highest temperatures, and, for this reason, lime cylinders are used for the electric light.

Slaked lime should dissolve in dilute acid without effervescence, showing the absence of carbonate, and the solution should give little or no precipitate with saccharated solution of lime showing the absence of phosphates, or of magnesia, derived from magnesian limestone having been used to prepare the lime, or of alumina.

*In Pharmacy.*—Employed in the preparation of slaked lime (Calcis Hydras) and of pure ether (See *Æther Purus*). On account of its avidity for water it is used in the laboratory for keeping the air dry in a limited space, e. g. a bell-glass, or a balance-case, and for absorbing water from solids and liquids, e. g. in the preparation of absolute alcohol. (App. I.)

*In Medicine.*—Not directly employed except occasionally as a caustic, mixed with an equal weight of caustic potash, forming *potassa cum calce* (Vienna caustic). This is prepared for use by being made up into a paste with a little alcohol, or, by being fused and cast into sticks. Mixed with betel nut it is largely used as a masticatory in India. Particles of lime accidentally introduced into the eyes of workmen, give rise to severe inflammation.

## CALCIS HYDRAS.



*Preparation.*—Add to lime about half its weight of water; much heat is generated, and steam evolved. The product is *slaked lime*, with any slight natural impurities ( $\text{MgO}$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{SiO}_2$ )

which the lime might contain. Sift it and keep it excluded as much as possible from the air, in order to prevent the absorption of carbonic acid gas.

*Characters.*—Slaked lime is whiter than quicklime. It may be obtained in crystals from its aqueous solution.

*In Pharmacy.*—Used to prepare the Hypophosphite and the solutions of lime, viz., the aqueous, Liq. Calcis, and the saccharine, Liq. Calcis Sacch. Also employed in many chemical operations, (a) to liberate other inorganic bases, e.g. ammonia (Liq. Amm. Fort.), potash (Liq. Potassæ, Pot. Chlor.), and soda (Liq. Sodæ); (b) in the preparation of some active principles, e.g. Atropia, Beberia Sulph., and of santonic acid (Santonin); (c) in the preparation of Chloroform, and in the purification of Ether.

*In Medicine.*—Not employed except in one or other of the following solutions. A particle of lime, accidentally introduced into the eye, may be removed by diluted vinegar.

### LIQUOR CALCIS.

*Preparation.*—Digest slaked lime in eighty times its weight of cold water for some hours. A saturated solution, known as “lime water,” is thus obtained, which must be kept in well filled stoppered bottles, in order to hinder absorption of carbonic acid gas. With a small quantity of water a white opaque mixture, “milk of lime,” is formed. As in the cases of Liq. Pot. and Liq. Sodæ, the bottle in which it is kept should preferably be of green glass, because the lime slowly dissolves the oxide of lead which exists in white glass.

*Characters and Tests.*—A colourless and limpid liquid when recent; but, on exposure to the air, or, if the breath be forced through it by a tube, a pellicle of insoluble carbonate of calcium forms, and, after continued exposure, the whole of the lime is ultimately precipitated. When the solution is heated part of

the lime is deposited, owing to its sparing solubility in hot water; the precipitate redissolves on cooling the liquid.

The strength of the solution is estimated by neutralising a known volume of it with the standard solution of oxalic acid, and it should contain at least  $\frac{1}{2}$  grain of lime per ounce.

*In Pharmacy.*—Used to precipitate certain metallic oxides, e. g. Oxide of silver, Mercuric oxide (Lotio Hydr. Flava), mercurous oxide (Lotio Hydr. Nigra). With an equal part of olive oil it forms an insoluble soap, oleate of calcium, viz., Linimentum Calcis.

*In Medicine.*—See Liq. Calc. Sacch. A caution is suggested by the following case:—At an inquest held in Birmingham some years ago, it was shown that a patient having been directed, among other things, to take a certain amount of lime-water every day; but, not being told whether to buy it, or make it himself, straightway procured some lime, mixed a lump with water, stirred it, and drank the thick mixture. A few hours afterwards symptoms of acute gastritis set in, resulting in death.

### LIQUOR CALCIS SACCHARATUS.

*Preparation.*—Mix slaked lime with twice its weight of sugar, and digest in water for a few hours.

*Characters and Tests.*—Colourless at first, but becomes yellowish by keeping. Its taste is much more caustic and disagreeable than that of Liq. Calcis. Slaked lime is much more soluble in solution of sugar, than in pure water; and, as this liquor contains 7·1 grains of lime per ounce, it is about twelve times as strong as ordinary lime-water. The amount of lime in the solution is estimated, as in the case of other bases, by neutralisation with the standard solution of oxalic acid. The solution is readily converted into carbonate of lime by exposure to the air; and when two-thirds of the lime are thus changed the liquid becomes viscid. Cane sugar combines with various

bases, and the soluble lime compound answers to the formula,  $C_{12}H_{22}O_{11}$ ,  $CaO$ . When heated, a precipitate falls, whose formula is  $C_{12}H_{22}O_{11}$ ,  $3CaO$ , and which redissolves on cooling. If carbonic anhydride be passed into the solution all the lime is precipitated, and pure cane sugar is set free.

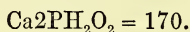
*In Pharmacy.*—Used in testing Calx and Calcis Carb. Præcip. for phosphates and alumina.

*In Medicine.*—Its main properties are antacid and astringent; and, as it renders the urine alkaline, it is advantageously given in cases of uric acid gravel. In 1739 the British Parliament voted £5000 as a reward to Joanna Stephens for her supposed remedy for the stone and gravel. It consisted of calcined egg shells (i. e. lime), soap, and several aromatic bitters. Lime is an efficient and safe antidote to poisoning by the strong acids, e. g. oxalic, but finds its chief sphere of usefulness in gastro-intestinal affections. In acid dyspepsia, with vomiting, it is the best adjunct to a milk diet; it is grateful to the stomach in gastrodynia, cancer, and gastric ulcer, and allays the vomiting of pregnancy. In dysentery and in diarrhœa, especially with children, its astringent qualities are highly valuable, and it seldom disagrees, except it be continued too long. The aqueous solution, lime-water, which is destitute of caustic taste, may be given in doses of  $\text{ʒss.}$  to  $\text{ʒij.}$ , or more; the saccharated solution,  $\text{ʒss.}$  to  $\text{ʒij.}$ , well diluted. Milk covers its offensive taste, and is the best vehicle for its administration. The Linim. Calcis is a favourite remedy in burns and scalds, and suits well in many cases of acute eczema.

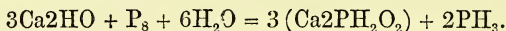
It is the best antidote (Husemann) to poisoning by carbolic acid.



## CALCIS HYPOPHOSPHIS.



*Preparation.*—Hypophosphorous acid is a feeble acid, and is monobasic,  $\text{HPH}_2\text{O}_2$ . The calcic salt, the first of the two recently officinal hypophosphites, is obtained by heating phosphorus with slaked lime and water.

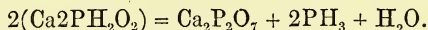


Some phosphate of lime is also formed at the same time.

The phosphuretted hydrogen ( $\text{PH}_3$ ) evolved is a spontaneously inflammable, badly smelling gas. Filter the solution, precipitate any excess of lime by carbonic acid gas, and concentrate the liquid until crystals form, using a gentle heat lest an explosion should occur.

*Characters and Tests.*—The hypophosphites of lime and soda are white salts with a bitter, nauseous taste, and are soluble in water, but the lime salt is insoluble in rectified spirit. Hypophosphites are distinguished from phosphates by not yielding precipitates with soluble salts of barium, calcium, or lead.

Heated to redness it is decomposed into calcic pyrophosphate, and burns with a phosphorescent light ;



*In Pharmacy.*—From this salt is prepared Sodæ Hypophosphis.

*In Medicine.*—Attention was called to the employment of the hypophosphites in phthisis by Dr. Churchill of Paris, and of late years they have come into some repute. They are especially recommended in the early stages of phthisis, and are considered to act as valuable stimulants to the nervous system, and to fulfil in most cases the indications for the use of phosphorus.

Parrish's syrup of the hypophosphites contains the hypophos-



phites of lime, soda, and potash. Dose, a teaspoonful, containing nearly five grains of the mixed salts.

## CALCIS PHOSPHAS.

Occurs under two heads in the Pharmacopœia—(a), Impure, as in *Os Ustum*, from which is derived; (b), Pure, *Calcis Phosphas*.

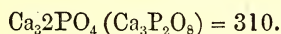
### (a). OS USTUM.

Bones consist of an animal tissue (33%), convertible into gelatin by boiling, in which is deposited a basis of earthy salts (66%). By proper treatment with water, bones yield size, glue, and other varieties of gelatin.

Neat's-foot oil is derived from the hoof-bones of the ox. When bones are calcined in *close* vessels, i. e. without free access of air, a black residue, containing the earthy salts mixed with charcoal, is obtained, and is termed *bone-black* (*Carbo Animalis*). But when bones are calcined in *open* vessels, all the animal and carbonaceous matter is burnt off, and a white friable residue, *bone-earth*, or *bone-ash*, is left, from which *cupels* are made. This bone-ash consists mainly of calcic phosphate and carbonate, and is used in pharmacy for the preparation of pure phosphate of lime and phosphate of soda. The precise components of bone-ash are  $\text{Ca}_3\text{2PO}_4$ ;  $\text{CaHPO}_4$ ;  $\text{CaCO}_3$ ; with traces of  $\text{CaF}_2$ , and of  $\text{MgHPO}_4$ .

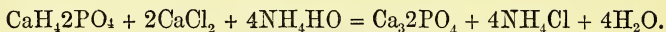
From this bone-phosphate, phosphorus and all its compounds are directly or indirectly prepared.

### (b). CALCIS PHOSPHAS.



*Preparation*.—(a), Digest bone-ash in diluted hydrochloric acid; the earthy salts are dissolved, the carbonate is converted into chloride of calcium, and the phosphate into super-phosphate;

$\text{Ca}_3\text{2PO}_4 + 4\text{HCl} = \text{CaH}_4\text{2PO}_4 + 2\text{CaCl}_2$ . (b), Add an excess of ammonia; pure tribasic phosphate is precipitated :—



Wash the precipitate free from chlorides, and dry at a temperature not exceeding  $212^\circ$ , to avoid undue aggregation of the particles.

*Characters and Tests.*—Insoluble in water, by the rule for neutral phosphates, but readily soluble without effervescence (absence of carbonate) in nitric, muriatic, or acetic acids, from which it is re-precipitated unchanged by ammonia, and, if the same weight, say 10 grains, be recovered as was operated on, its purity is proved. The presence of lime in the salt is proved in its acetic acid solution, made with nitric acid and excess of acetate of soda, by precipitation with oxalate of ammonia, and of phosphoric acid by precipitation with perchloride of iron.

*In Pharmacy.*—It enters into the composition of Pulvis Antimonialis, the officinal representative of “James’ powder.”

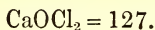
*In Medicine.*—Has been theoretically recommended in scrofulous and rachitic conditions of the system, and it has of late years become the fashion to combine it with other phosphates, such as those of iron, soda, &c., in the form of syrup.

### PLASTER OF PARIS (APP. I.)

#### SOLUTION OF SULPHATE OF LIME (APP. II.)

Native sulphate of calcium (gypsum)  $\text{CaSO}_4\cdot 2\text{H}_2\text{O}$ , when deprived of its water by a moderate heat, yields *Plaster of Paris*,  $\text{CaSO}_4$ . A solution of this in water (1 in 400 nearly) forms a test liquid used to detect oxalic acid in Acidum Tartaricum. If gypsum be heated to redness it loses its power of chemically combining with water and becoming hard, i. e. it would be impossible to take casts with it. It does not, however, lose its solubility in water.

## CALX CHLORATA.

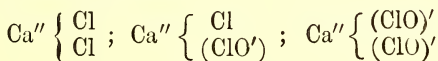


*Preparation.*—Saturate damp slaked lime with chlorine gas ;  
 $\text{CaH}_2\text{O}_2 + \text{Cl}_2 = \text{H}_2\text{O} + \text{CaOCl}_2.$

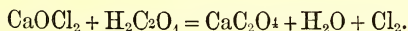
It was introduced in 1798 by Tennent and Macintosh of Glasgow.

*Characters and Tests.*—There is some difference of opinion as to the exact constitution of this substance, the familiar “chloride of lime.” It must on no account be confounded with the body, chloride of calcium, and, in prescribing, care should be taken to write its name in full. Their constitution and properties are wholly different. The simplest view of its formula is  $\text{CaOCl}_2$ , but many chemists, following Balard, consider it to be formed of a mixture of chloride and hypochlorite of calcium, which correspond to the above formula doubled, thus,  $2\text{CaOCl}_2 = \text{CaCl}_2 + \text{CaCl}_2\text{O}_2$ . From the above formula we see that the group  $\text{CaO}''$  in this compound is diatomic, and so follows a different arrangement from quick lime,  $\text{CaO}^\circ$ , which is a saturated body, and therefore, strictly speaking, a chloride of *lime* is impossible.  $\text{CaO}$ , when diatomic, is, for the sake of distinction, termed *calcyl* ; i.e., the bleaching powder is chloride of *calcyl*.

Or, it may be regarded as intermediate between chloride and hypochlorite of calcium, thus,



Under either view it is an unstable body ; every acid, even carbonic, decomposes it, and liberates the whole of its chlorine. With oxalic acid, for example,

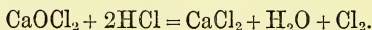


Hence it gives off chlorine when exposed to the air, gradually deteriorates, and is converted into chloride and carbonate of calcium. If it contain much chloride of calcium it will be moist,

and is then of inferior quality. It is stated that explosions sometimes occur spontaneously in bottles filled with "bleaching powder," which have not been satisfactorily explained.

It has an acid, bitter taste, a chlorinous odour, and, although entirely soluble in water when quite pure, it generally contains some free hydrate of lime, and is therefore only partially soluble. Its bleaching and other valuable qualities depend upon the evolution of chlorine, and consequently the purity-test (chlorimetry) consists in determining the amount of chlorine which can be set free by acids from a given weight of the "bleaching powder." There are three distinct steps in the officinal test.

(a). Chlorine is liberated by hydrochloric acid :—



(b). The free Cl in contact with an excess of iodide of potassium liberates an equivalent amount of iodine, which dissolves in the excess of potassic iodide, and forms a red solution.  $\text{KI} + \text{Cl} = \text{KCl} + \text{I}.$

(c). Lastly, the amount of free iodine (one atom I = one atom Cl) is determined as usual by ascertaining how much hyposulphite of sodium is required to discharge the red colour. The hyposulphite and iodine form two colourless compounds, iodide and tetrathionate of sodium,  $2\text{Na}_2\text{S}_2\text{H}_2\text{O}_4 + \text{I}_2 = 2\text{NaI} + \text{Na}_2\text{S}_4\text{O}_6 + 2\text{H}_2\text{O}.$  1000 grain-measures of the sodium solution = 12·7 grs. I = 3·55 grs. Cl. Therefore, when, as in the officinal test, 850 grain-measures are required for 10 grs. of the chlorinated lime, this indicates 3.017 grs. Cl = 30%.

*In Pharmacy.*—(1.) Like chlorine gas (Liquor Chlori), calx chlorata is a powerful indirect oxidiser, and is used for converting ferrous into ferric salts. It oxidises organic matter powerfully. The oxygen is derived not from the lime salt, but from the decomposition of water, thus,  $\text{H}_2\text{O} + \text{Cl}_2 = 2\text{HCl} + \text{O}.$  (2.) It converts rectified spirit into chloroform. (See Chloroformum.)

*In Medicine.*—Its principal applications fall under the head

of a stimulant astringent, deodoriser, antiseptic, and probably a disinfectant.

*Locally*, under the first two indications, it is a most useful application in solution to ill-conditioned ulcers, chilblains, &c. An excellent combination is formed of equal parts of Liq. Calc. Chlor., and Liq. Plumbi Subacet. Dil. (lead lotion). In fetid discharges from the ear, uterus, or rectum, it is highly serviceable as an injection. As a gargle in gangrenous sore throat, or as a mouth-wash in cases of ulcerated gums, fetid breath, and other similar conditions, it is a valuable agent. Its disinfecting and antiseptic properties have been largely utilised in hygiene and medical police, although, of late years, carbolic acid, and other antiseptics, have come more prominently forward for this purpose. To promote the evolution of chlorine a small quantity of any acid should be added to the aqueous solution.

*Internally*, in typhoid fever and dysentery, especially when the stools are very fetid. In foul eructations it is given with advantage, and in gangrene of the lungs, or putrid affections of the throat, the vapour from 2 oz. moistened (Vapor Chlori) may be cautiously inhaled.

The dose of the Liquor is from 10 to 30 minims.

### CALUMBÆ\* RADIX.

*Origin*.—Calumba consists of transverse sections of the tuberous root of *Jateorrhiza Columba* and *J. Miersii* (*Cocculus palmatus*), N.O. Menispermaceæ, and it is derived from Mozambique on the south-east coast of Africa.

*Characters*.—The oval yellow discs, with a brownish, wrinkled epidermis, and a rather spongy medullary portion, often marked with concentric circles, and radiating lines, distinguish Calumba readily from all other drugs. The best Calumba is bright

\* Colombo, a city in Ceylon, whence it was formerly erroneously supposed to be derived. Or, from *Kalumb*, the native term.

yellow, compact, and not worm-eaten. The colour of the root is probably due to the presence of berberin,  $C_{20}H_{17}NO_4$  (not to be confounded with beberin), a yellow alkaloid, widely diffused throughout the vegetable kingdom, and contained not only in the Barberry (N. O. Berberidaceæ), and in Calumba, but also in Podophyllum (N. O. Ranunculaceæ), &c. Calumba also contains a neutral, colourless, and crystallisable principle termed *calumbin*. The odour is slightly aromatic, and the bitter taste is much more marked in the cortical portion. The root is little liable to adulteration; but it is stated that the roots of *white bryony*, tinged yellow with tincture of turmeric, of *American calumba* (*Frasera Walteri*, which contains tannin), and of *false calumba* (*Coscinium fenestratum*), have been substituted for it.

*In Pharmacy.*—Calumba yields its virtues both to water and alcohol, e. g. Infusion and Tincture. It contains no tannic acid, and therefore does not blacken salts of iron; and it includes one-third of its weight of starch, and hence the infusion is made with *cold* water, which extracts only the bitter tonic matter. A cold decoction is blackened by solution of iodine from the excess of starch present.

*In Medicine.*—An useful, pure, bitter tonic, without astringency, and generally acceptable to the stomach. Often prescribed with great advantage in simple dyspepsia, in the debility of convalescence from acute diseases, and is frequently combined with other tonics and aromatics, e. g. Mist. Ferri Arom.; or with mild cathartics, or antacids, e. g. bicarbonate of sodium. It has been highly recommended as a sedative in cases of functional vomiting, as in the sickness of pregnancy, and it is an approved tonic in chronic diarrhœa.

The Infusion, dose  $\mathfrak{z}i.$ , and the Tincture, dose  $\mathfrak{z}ss.$  to  $\mathfrak{z}i.$ , are most frequently ordered.



CALX. (See p. 173.)

CALX CHLORATA. (See p. 181.)

CAMBOGIA.\*

*Origin.*—The exact source of this gum-resin was long undetermined; but it has recently been referred by Mr. Hanbury to *Garcinia Morella*, N. O. *Guttiferæ*, a native of Siam and Cochin-China. It is procured by making incisions into the stem, or by cutting away a portion of the bark, and scraping off the juice which exudes.

*Characters and Tests.*—The best gamboge (pipe gamboge) is in cylindrical rolls, one inch or more in diameter, often hollow in the centre, and sometimes bent or agglutinated into masses. The form and the longitudinal striations on the surface are due to the collection of the exuding juice in bamboo canes. An inferior variety, imported in large irregular masses, is termed *cake* or *lump* gamboge. This is sometimes adulterated with starchy matter, which is detected as usual by the iodine test. But, on account of the yellow colour of the gamboge, the iodide of starch will appear *green* instead of blue.

Gamboge has no smell, and but a slight acrid taste; the smallest quantity of the powder inhaled causes sneezing and a flux from the nostrils, i. e. it is an errhine. Sp. gr. 1.22. It burns with a white flame and much smoke; and it is a pure gum-resin, devoid of volatile oil; the proportion of resin varies from 74 to 80%. When pure it is completely dissolved by the successive action of ether (resin) and water (gum). The yellow resin is termed gambogic acid,  $C_{20}H_{24}O_4$ , and forms dark-red solutions with the alkalis. The resin imparts a perceptible yellowness to 10,000 times its weight of spirit, and is a comparatively feeble cathartic. It

\* Cambodia, a river of the province in which it is collected.

is not yet known upon what the drastic quality of gamboge depends.

*In Pharmacy.*—Occurs only in Pil. Camb. Co. In the arts it is highly esteemed as a pigment.

*In Medicine.*—An irritant hydragogue cathartic, capable of proving fatal in overdoses, e. g. 60 grs. It is seldom given by itself, but is usually conjoined with other purgatives, e. g. aloes, as in the officinal pill.

It is chiefly employed in the treatment of obstinate constipation, and of dropsy, especially when attended with torpid bowels. In the latter case, it may be combined with cream of tartar and jalap. The dose of the Pil. Camb. Co. is from 5 to 10 grs.

Gamboge is an ingredient of the nostrum, Morison's Pills, from the improper use of which numerous deaths have resulted. These pills have been found to contain Aloes, Gamboge, Colocynth, Gum, and Cream of Tartar (Royle).

### CAMPHORA.\*

*Origin.*—Camphor is a solid volatile oil, or stearoptene, obtained from the wood of *Camphora officinarum*, N. O. Lauraceæ. It is the sole officinal example of a concrete essential oil, and, as it exists in all parts of the plant, is readily extracted from the root, trunk, and branches, by boiling the chips in a little water in an iron pot, and collecting the condensed product in an earthen capital. As imported, it is in greyish-white grains (China or Formosa camphor) or granular masses (Japan or Dutch camphor), and constitutes what is termed "crude camphor." In order to refine it for medicinal purposes, this crude camphor is heated with a small quantity of quicklime in an iron vessel, and the sublimed vapour is received into a spheroidal thin glass globe called a "bombolos." When the glass vessel is broken, the hemispherical

\* *Cáfur*, Arab.; *Κάφουρα*, Gr.

mass of camphor, about three inches thick, is removed. The dome of camphor weighs about 11 lbs., and is perforated in the middle.

Many other plants besides the camphor-laurel contain camphor in appreciable quantities, e. g. Sassafras, Cardamoms, the Labiatae, and some Compositae, and, in all cases, it appears to result from the oxidation of a pre-existing volatile oil. In the case of ordinary camphor, the liquid volatile oil,  $C_{20}H_{32}O$ , which exists in the wood deposits crystals of camphor,  $C_{10}H_{16}O$ , on exposure to the air,  $C_{20}H_{32}O + O = 2C_{10}H_{16}O$ .

*Characters and Tests.*—The tenacity of camphor renders it difficult to powder, but the addition of a few drops of alcohol or ether will overcome the cohesion of its particles, and facilitate its pulverisation. It may be obtained in powder also by precipitating the tincture with water, or by grating and afterwards sifting it. Its sp. gr. lies between 0.985 and 0.996, and its density varies considerably with the temperature. A fragment thrown upon the surface of water, mercury, or urine, in a *perfectly clean* vessel, free from oil, executes singular gyratory movements, owing to the vaporisation of the camphor, and the impulsion of the vapour against the surface of the liquid. Camphor is very inflammable, and burns readily with a white flame even when ignited upon water. It melts about  $300^{\circ}$ , and boils at  $400^{\circ}$ . When confined in a bottle for a length of time, it will often form large and beautiful six-sided crystals on the inner surface, which, when held up against the light, sparkle like diamonds. Camphor requires 1000 parts of water for solution under ordinary circumstances, so that one ounce of Aqua Camph. will contain less than half a grain; but, water impregnated with carbonic acid gas, sugar, myrrh, or carbonate of magnesia, will dissolve or at least emulsify a much larger proportion. Murray's fluid camphor is a solution of camphor in "fluid magnesia." Camphor is readily soluble in rectified spirit, nearly 1 in 1, e. g. Lin. Camph. Co., Spir. Camph. Acetic acid, as in "aromatic vinegar," ether, and chloroform, likewise take it up readily.

The Linim. Camph.; Ung. Hydr. Co.; and Ung. Pl. Subacet.

Comp., exemplify the solubility of a volatile oil in a fixed oil, and the Linim, Terebinth, illustrates the solubility of one volatile oil in another member of the same group.

Alkalies and their carbonates do not act upon camphor. A few grains when heated should sublime entirely, otherwise some fixed impurity, e. g., sand, would be indicated. Sal-ammoniac,  $\text{NH}_4\text{Cl}$ , is said to be sometimes used to sophisticate it, but the fraud could easily be detected by agitating the specimen with a little water in a test-tube, filtering and adding nitrate of silver to the filtrate, when a white precipitate,  $\text{AgCl}$ , would be formed. There is another kind of camphor, Borneo, Malay, or Sumatra camphor, which is not met with in this country on account of its rarity and enormous price. It is heavier than water, and is less volatile and more opaque than Chinese camphor. It is the product of a totally different tree, *Dryobalanops Camphora*, N.O. *Dipterocarpeæ*, and occurs in solid masses in the interior of the wood. Its formula is  $\text{C}_{10}\text{H}_{18}\text{O}$ , or rationally,  $\left. \begin{array}{c} \text{C}_{10}\text{H}_{17} \\ \text{H} \end{array} \right\} \text{O}$ , i. e. campholic alcohol. It accordingly differs from laurel-camphor by containing  $\text{H}_2$  more, and, if oxidised by nitric acid, it loses the  $\text{H}_2$ , and is so converted into ordinary camphor, i. e., its aldehyd. There is a third and less known kind of camphor, termed Ngai camphor, derived from *Blumea balsamifera*, N.O. *Compositæ*. It appears to be isomeric with Borneo camphor. When rubbed up with chloral, equal weights, Ngai camphor, like common camphor and Borneo camphor, liquefies.

*In Pharmacy.*—Camphor is added to many of the Liniments on account of its agreeable odour and stimulating qualities. In prescribing camphor it is well to remember that with some resinous substances, e. g. benzoin, balsam of tolu, and ammoniacum, it forms a soft mass which will not mould into pills, while at the same time its odour is weakened or destroyed.

The Linimentum contains twice as much camphor as the Spiritus Camphoræ.

*In Medicine.*—According to the recent inquiries of Dr. J.

Harley, camphor appears to exert its action chiefly upon the cerebral lobes, causing at first depression of mental power, giddiness, and somnolency. Delirium comes on later, and, if the use of the drug be continued, it produces great depression of muscular power and intellectual lethargy. It certainly is not a vascular depressant in medicinal doses, and seems both to be rapidly and completely absorbed, and as completely decomposed. Much ignorance prevails as to its real properties, owing to the insignificant doses in which it is commonly exhibited. In doses not exceeding 35 grs. the effects are uniform, and consist simply in giddiness, languor, and a diffused feeling of warmth through the body—the digestive, respiratory, and, with few exceptions, the circulatory systems, remaining unaffected. Harley states that the urine is normal in quantity and composition, and is entirely free from the odour of camphor, which, moreover, is not in the least degree appreciable in the cutaneous or pulmonary exhalations.

Given in small doses it may be ranked among the diffusible stimulants, and it is valued in the treatment of various nervous and depressing diseases, e. g. in the low stages of continued fevers, in cholera, summer diarrhœa, &c. As an antispasmodic it is useful in hysterical affections, in asthma, and in angina pectoris. It is stated to act as an antidote in poisoning by cantharides and other renal irritants, and to allay the pain of strangury and of chordee. It is also generally credited with anaphrodisiac powers. Hence the line of the Salernian school, *Camphora per nares castrat odore mares*. A pill composed of camphor, 2 grs., and extr. bellad. gr. i., given three times a day, is very useful in dysmenorrhœa. In cases of nasal and frontal catarrh, i. e., a “cold in the head,” much relief is often obtained in their early stages by sniffing up a strong solution of camphor, or a mixture of powdered camphor and white sugar.

*Externally.*—Camphor is decidedly stimulant, and is popularly much used in rheumatic and gouty affections, and as an

application to chilblains, sprains, &c. It occurs to a greater or less amount in twelve out of the sixteen Liniments. The Linim. Camph. Co. acts as a powerful rubefacient on account of the ammonia in it, and is well adapted for young children or very old people. Camphor sometimes relieves itching of the skin or pruritus, and may be advantageously added to starch powder mixed with oxide of zinc, or a little spirit of camphor may be incorporated with zinc or other ointment.

There is little use in giving camphor in doses below 5 grs. for an adult, and, as we have seen, much more may be given with propriety. None of the officinal preparations are eligible for its proper administration. The Aqua and Tinct. Camph. Co. contain too minute quantities of the drug, while the large amount of rectified spirit in the Spiritus Camph. renders that form objectionable. Owing to its bulkiness when powdered, not more than two or three grs. can be worked up into a pill, and an emulsion made with sugar, gum, and the yolk of an egg is a disagreeable form, and more suitable for an injection. New milk, however, furnishes an appropriate vehicle, for it dissolves  $\frac{1}{8}$  of its weight of camphor, and the solution is miscible with water without the camphor being precipitated.

### CANELLÆ\* ALBÆ CORTEX.

*Origin.*—The decorticated bark of the branches of the Wild Cinnamon, *Canella Alba*, N. O. Meliaceæ (Canellaceæ). At one time this tree was supposed to yield true Cinnamon.

*Characters.*—It is the lightest coloured bark used in medicine, and is nearly as white as flake manna. The whiteness combined with its aromatic spicy odour and taste quite characterise it. It contains a considerable quantity of an acrid, yellowish, fragrant volatile oil, but is destitute of tannic acid.

\* *Canna*, a reed, the pieces being rolled up like a reed.



*In Pharmacy.*—Rejected from the Pharmacopœia of 1864, it has been re-introduced for the sole purpose of aromatising rhubarb wine.

*In Medicine.*—An agreeable cordial tonic suitable as an addition to other tonics or to purgative medicines, but scarcely ever prescribed. Mixed with powdered aloes (four parts, hepatic aloes, one part, canella), it formed what was called *hiera picra*, a once popular aloetic remedy.

### CANNABIS INDICA.\*

*Origin.*—Although known to the Hindoos for centuries it was first introduced into European practice by Dr. O'Shaughnessy in 1838. The hemp plant of India,† at one time considered to be a distinct species, is now believed to be identical with the common hemp, *Cannabis sativa*, N. O. Urticacæ, which is cultivated in these countries. But it illustrates well the influence of climatic conditions upon vegetable life. In temperate climates the bark-fibre is valuable and the resin scanty, while in India the resin is abundant and highly active, and the fibre is indifferent in quality. Accordingly it is from the Indian variety alone, that the medicinal preparations are made. The whole plant is clammy with resinous exudation, and the resin is probably collected by rubbing the hemp-tops between the hands and then scraping it off. The plant is an annual, and is diœcious (i. e. the sexes are on separate individual plants), and the resin is derived from the female or pistillate plant.

*Characters.*—Imported in bundles of twenty-four plants (gunjah) about two feet long, consisting of the compressed branches, flowers, and fruits, of a greenish-brown colour, and with a heavy,

\* Κάνναβις, hemp.

† The term *Indian hemp* is also sometimes applied to the *Apocynum cannabinum*, N. America.

mawkish odour; the bundles become dark-brown on keeping. The Arabian *haschisch* is of a similar nature, but the *haschisch* of the Peruvians and Mexicans is quite different, and consists of the leaves (coca) of a shrub, *Erythroxylon coca*, N. O. Malpighiaceæ. The term "bhang" is applied to a mixture of the larger leaves and fruits without the stems, and the separated resin is termed "churrus." The active principles of the plant are the resin (cannabin) and the volatile oil.

*In Pharmacy.*—On account of the amount of resin, rectified spirit is requisite in making the Extract and the Tincture, each of which is a dark, opaque green. The tincture gives an abundant green precipitate with water.

*In Medicine.*—Its main action is that of an intoxicating narcotic, causing excitable and agreeable delirium with vivid hallucinations, followed by drowsiness and stupor. Extraordinary confusion of ideas is produced as well as misconception of time and of the position of surrounding objects. Persons under the influence of *haschisch* sometimes become furious and even murderous; hence the Eastern term *Haschaschins* and our own word *assassins*. It rather increases the appetite, and is said to be a decided aphrodisiac. Occasionally a cataleptic state has been produced. In some respects it resembles opium; and is a suitable substitute when that drug fails, but it differs in action in not contracting the pupil, in not causing loss of appetite, or checking the secretions, and in being less certain in its effects. The latter is, no doubt, largely owing to the inferior quality of the drug used, for half an ounce of the extract has been taken without sensible effect, while  $\frac{2}{3}$  gr. of *good* extract suffices to produce unmistakable narcotic action.

Carnivorous animals and fish are more easily intoxicated by it than herbivora.

It has been chiefly used as an anodyne in neuralgia, chronic rheumatism, and headache, as a hypnotic in delirium tremens,

and insanity; as an antispasmodic in hysteria, asthma, tetanus, hydrophobia, and infantile convulsions. It is also stated to be a direct stimulant to the uterus, and has been much praised in the treatment of menorrhagia. The urine of patients under its influence sometimes acquires a peculiar odour like the Tonquin bean.

The average dose of the extract is  $\frac{1}{2}$  to 1 gr. in pill, cautiously increased, and of the tincture 10 m. gradually augmented. The addition of mucilage is advisable in order to suspend the resin, or, a few drops of an alkaline liquid, e.g. Spir. Ammon. Arom. may be added to keep it in solution.

### CANTHARIS.\*

*Origin.*—Several genera of beetles (e.g. Melœ, Mylabris) are or have been used as vesicating agents; but in Britain, and most parts of Europe, only the one kind is recognised, the Cantharis† vesicatoria, Ord. Coleoptera. In the common appellation, *Spanish flies*, there are two errors, for the insect is a beetle, and *not* a fly, and does *not* come, at least chiefly, from Spain. They were at one time imported into this country from Spain; the finest insects are now derived from Russia. They feed principally upon the leaves of the white poplar, elder, privet, ash, and lilac, and are collected in May and June, the time of swarming. The three last-named trees (N. O. Oleaceæ) are perhaps preferred by the beetle on account of the presence of a saccharine principle or manna. When the trees are shaken the insects fall upon linen cloths spread underneath. They are then killed by plunging them into vinegar, or by exposure to the vapour of boiling vinegar, spirit, or oil of turpentine. When perfectly dry they are carefully packed in boxes. The an-

\* Κάνθαρος, a beetle.

† *Lytta* was at one time adopted as the generic name, and even still we occasionally hear of Emplastrum Lyttæ, &c.

cients believed that the virus existed only in the body of the beetle, and that the head, feet, and wings, contained its antidote.

*Characters and Tests.*—The lustrous green colour of the wing-sheaths is highly characteristic, and may be detected with a lens even through a very fine powder. The wing-cases are very durable, and the shining particles have been recognised in the human stomach months after interment. The disagreeable odour, which is quite perceptible in dried specimens, is so strong in the living insects, that by it swarms may be perceived at a considerable distance, and it is unpleasant to walk in their neighbourhood. They have an acrid, burning taste. If kept perfectly dry they will long retain their activity, even for thirty years; but in damp air, especially when in powder, they quickly undergo putrefaction. It is advisable to preserve the insects whole. They are very liable to the attacks of mites (*acarus*), and other parasitic insects, which destroy all the interior soft parts, and so weaken their vesicating qualities.

Camphor, chloroform, strong acetic acid, &c., have been recommended as preservatives; but the simplest and most effectual method is to expose the dried and sifted entire insects in clean bottles to the heat of boiling water before storing them. The chief and active constituent of cantharides is a white, fusible, crystalline substance, named *cantharidin*, which is found in all parts of the beetle, and was discovered by Robiquet in 1818.

One thousand parts of powdered insect yield four parts of pure cantharidin. The active vesicating power of cantharidin serves to identify it in medico-legal investigations.

*In Pharmacy.*—Cantharides enters into seven preparations, all of which, except the Tincture, are for external use only. Cantharis yields up its active properties to acetic acid, e.g. *Acet. Canthar.*; to fixed oils, e.g. *Charta Epispastica* and *Ung. Canthar.*; to ether, e.g. *Liq. Epispast.*; to spirit, e.g. *Tinct. Canthar.*; to water, e.g. in the preparation of *Ung. Canthar.* Pure

isolated cantharidin is insoluble in water, and is only sparingly soluble in cold spirit; but, as it exists in combination in the insect, it is soluble in these menstrua. The Liq. Epispast. is four times as strong as the Acetum Canth., which again is eight times as strong as the Tincture. Empl. Cantharidis is eight times as strong as Empl. Calefaciens.

*In Medicine.*—*Internally*, Cantharides acts as a powerful stimulant, more peculiarly to the urinary genital organs, and over-doses cause very severe symptoms, viz., pain, strangury, bloody urine, &c. Fatal doses produce besides, obstinate priapism, bloody stools, and intense abdominal pains, dependent on irritation of the intestinal mucous membrane, salivation, burning thirst, convulsions, and delirium. Twenty-four grs. of the powder have proved fatal in a pregnant woman, having first caused abortion. The proper treatment in a case of over-dose consists in emetics, diluent drinks, and, above all, opiates by the stomach and rectum; but there is no true antidote. Camphor was long ago recommended as an antidote, and liquor potassæ, 20 to 30 m., is beneficial in the alleviation of the strangury. Cantharides in small quantities sometimes operates as a diuretic, and has been used in renal dropsy. It is not unfrequently prescribed in obstinate gleet, and leucorrhœa, and, in incontinence of urine from debility, it will often afford relief. In certain chronic eruptions, psoriasis, and eczema, cantharides has proved useful after arsenic had failed. The average dose of the Tincture is about 10 m.

In 1693, Dr. Groenevelt was cited before the censors of the London College of Physicians, and committed to Newgate, for prescribing cantharides internally for the cure of the stone, but was acquitted on the plea that bad practice must be accompanied with a bad intention to render it criminal. The Doctor published his vindication in a small tract, “De Tuto Cantharidum in Medicina Usu Interno,” but he was ruined by the transaction.

*Externally*, Cantharides is extensively used as a rubefacient,

e. g. Empl. Calefac., in rheumatic pains, chronic catarrh, &c., or as a vesicant, e. g. Liq. Epispasticus, chiefly in the latter capacity, and is calculated to answer numerous indications. Blisters exert both local and remote effects, and merely a few instances of their application can be given here, for a discussion of the theory of counter-irritation would occupy too much space. As local serous derivatives they are placed over or near chronic effusions into joints with great benefit, and, contrary to what might be expected, they relieve the pain of acute rheumatic arthritis. As local stimulants they are used in some cases of partial paralysis, old callous ulcers, obstinate skin eruptions, and alopecia. By means of them, or preferably by Acet. Canthar. or by the non-official "vesicating collodion" (prepared by mixing Liq. Epispasticus,—made with glacial acetic acid,—3 x., with gun cotton  $\frac{1}{4}$  oz.), the cuticle is removed for the endermic application of remedies, such as morphia. As remote stimulants, probably by reflected nerve-influence, they are employed in low fevers, and "flying blisters" (i. e. a succession of small blisters left on for a *short time*) along the side of the neck were strongly recommended by Graves in cases of severe nervous disturbance in continued fever. Here the primary stimulant action of the blister is gained without the depleting and depressing effects of vesication.

Neuralgia of one part of the body is often best treated by a blister at a distant part, e. g. over the posterior root of the painful spinal nerve in herpes zoster, or the back of the heel in sciatica, &c.

Blisters should not be placed over an acutely inflamed lung or pleura, but in cases of lingering pneumonia or chronic pleural effusion their use is often followed by the best effects. They should not be applied over the scrotum or mamma, where the skin is thin and tender, nor at all to the chest during pregnancy.

Cantharides causes more effusion under the skin than any other local irritant except boiling water or steam, and it is a sure vesicant. The least trace,  $\tau_{00}^1$  gr. of cantharidin, will raise a blister on the skin. Blisters require from five to eighteen or twenty-four



hours to rise, the time varying with the situation, condition of the patient, &c. If not closely applied to the skin, or if a bubble of air be enclosed, partial vesication will ensue. In a large blister it is advisable to cut a hole in the centre to allow of the escape of air and to permit its better adaptation. The skin should be moistened with water or vinegar, for blisters rise with difficulty on a dry epidermis. If left on too long, especially in weak states of the body, as in fever, or if applied incautiously to very young children or aged persons, or to individuals with a very sensitive skin, troublesome ulceration, and even sloughing, are apt to occur, with severe constitutional irritation, and, in not a few cases, death has been caused. The Charta Epispastica, a substitute for "D'Albeyspeyre's paper," is an elegant and cleanly equivalent for the more clumsy and dirty *fly blister*.

Irritant urinary effects from absorption of cantharidin are very liable to arise in some persons, and it is doubtful whether they can be prevented with certainty, although several means have been proposed. The safest plan is to leave the blister on long enough to cause redness only, and then to apply a poultice, when vesication will readily take place without pain. A full opiate enema or hypodermic injection of morphia will at once relieve the symptoms. Pregnant women bear blisters badly. A blister is usually dressed with simple ointment, but a very good plan is to remove the cuticle altogether, and dress the surface with a thick layer of cotton wool, beneath which the skin heals rapidly. If much itching remains behind it may be relieved by Liq. Plumbi Subacetatis with a little olive oil. A "perpetual" or "open blister" is obtained by dressing the vesicated surface with some irritant such as Ung. Canthar.; Ung. Sabinæ; or better still, by a succession of blisters, which cause little or no pain after the second or third. In young children or with irritable skins it is well not to open the blister at all, the serum forms the best dressing for the excoriated skin. Pigmentary stains often remain long after the blister is healed.

## CAPSICI\* FRUCTUS.

*Origin.*—Several species of *Capsicum*, N.O. Solanaceæ, yield Cayenne or red pepper, but the Pharmacopœia recognises only one, viz.: *C. fastigiatum*, a small-fruited species. The larger fruits of *C. annuum* are known as *chillies*, and are officinal in the U. S. Pharmacopœia. Much of the Cayenne pepper from the East and West Indies is derived from *C. baccatum* and *C. frutescens*.

*Characters.*—The most prominent character of the ripe fruit is its persistent, fiery hot taste. The red colour of powdered capsicum gradually fades upon exposure to light, and ultimately disappears. The odour is peculiar and aromatic. The active principle is a pungent oleo-resin (capsicin) which can be extracted by ether;  $\frac{1}{2}$  gr. of capsin volatilised in a large room excites cough and sneezing in those who breathe the air of the room.

Powdered capsicum is sometimes attacked by insects, and is adulterated with red oxide of lead, and with coloured sawdust.

*In Medicine.*—Its main action is that of a powerful non-narcotic stimulant acting principally on the circulation and digestive system. It is, therefore, singular among the Solanaceæ, which are generally narcotic in action, and scarcely, if at all, acrid. It is justly esteemed as a condiment, and is occasionally prescribed in languid digestion, atonic gout, and as an adjuvant to cathartic or tonic medicines. A writer states that one of his friends who had resided for a long time in the East Indies eat capsicum upon his bread and butter, the layer of red pepper being equal to the butter in thickness. Given in large doses it has been specially recommended in the treatment of delirium tremens.

*Locally,* It is sometimes employed as a gargle in scarlatinal and relaxed sore throats,  $\bar{3}$  ss. Tinct. Capsici to  $\bar{3}$  viij. Rose Water.

\* *Κάπτω*, to devour; from its biting qualities.

Externally applied it is a powerful rubefacient, acting speedily without risk of vesication. Some of the popular rubefacients consist essentially of preparations of capsicum, e. g. the so-called “mustard leaves.”

### CARBO\* ANIMALIS.

Two bone-residues, one white and the other black, are officinal. Bones consist of gelatinous animal matter with lime salts. When heated to redness *in contact with air* all the animal matter is burnt off, and a white residue remains (Os Ustum) composed chiefly of calcic phosphate and carbonate. But if exposed to a red heat in a close vessel *without access of air*, the animal matter is only partially destroyed, an ammoniacal liquor (bone spirit) comes over, and most of the carbon of the animal substance remains behind mixed with the incombustible lime salts, and when powdered, constitutes bone-black, sometimes incorrectly called ivory-black.

Bone-black consists of about 90% of phosphate and carbonate of lime with traces of other salts, and 10% of charcoal. For some purposes it may be employed as it stands, but in the Pharmacopœia it is directed to be purified from the earthy salts by the following process. Crude animal charcoal may be obtained from any animal substance, and a fine variety is procured by burning dried blood.

### CARBO ANIMALIS PURIFICATUS.

*Preparation.*—Digest bone-black in dilute muriatic acid in a warm place for two days. Filter, wash thoroughly, dry, and ignite in a closed crucible. The acid dissolves out all the impurities, leaving the charcoal untouched. Soluble chloride and superphosphate of calcium are formed.

*Characters.*—Its most important quality is its remarkable

\* Κάρφω, to make dry.

power of absorbing colour, as is illustrated by filtering tincture of litmus through it. When burned at a high temperature with the aid of a little red oxide of mercury (to furnish additional oxygen) it leaves scarcely any residue, and is thus distinguished from vegetable charcoal and from bone-black. Well-prepared animal charcoal does not leave more than  $\frac{1}{200}$  of spongy ash.

*In Pharmacy.*—Used solely as a decoloriser in the preparation of Atropia, Digitalin, Santonin, Hydrochlorate of Morphia, and Veratria. Some loss is apt to occur by absorption of the active principles themselves.

Animal charcoal is the material employed in decolorising brown sugar for the production of white sugar.

*In Medicine.*—Proposed by Dr. Garrod as an antidote to vegetable and animal poisons, especially to the alkaloids, strychnia, &c. The dose must be large, half an ounce and upwards, and its efficacy is not to be relied on. Although possessed of deodorising powers similar to those of vegetable charcoal it is not usually prescribed internally.

## CARBO LIGNI.

*Preparation.*—Just as bone-black is the residue of imperfectly burned bones, so wood charcoal is the product obtained by exposing wood to a red heat without access of air. The wood, when charred in iron cylinders, yields about  $\frac{1}{2}$  of its weight of charcoal, and among the volatile products are creasote, and pyro-ligneous acid, i. e. impure acetic acid (See Acidum Aceticum). The finest charcoal is made from young willow or poplar shoots, and for medicinal purposes it should be recently prepared. Other varieties of charcoal are *lamp-black*, obtained from the decomposition of oils, and *coke*, prepared by heating coal in close vessels.

*Characters.*—Easily distinguished from animal charcoal by leaving a *bulky*, white mineral ash, amounting to 1 or 2%, after

thorough combustion. Charcoal possesses in a remarkable degree the power of absorbing large quantities of many gases. Through absorption of atmospheric oxygen, when placed in contact with organic matters it acts as an oxidiser, and while thus favouring their decomposition, it destroys at the same time all noxious odours. It is not so energetic a decoloriser as animal charcoal. When placed in contact with some strongly-smelling substances, e. g. valerian and musk, it is stated to absorb their odour. It is a bad conductor of heat, but a good one of electricity, and is often used as the negative plate of voltaic cells and as a material for electrodes.

*In Pharmacy.*—With the assistance of heat it exercises a strong affinity for oxygen to form carbonic oxide or carbonic anhydride. For this purpose, i. e. as a deoxidiser, it is used in the preparation of sulphurous acid from sulphuric acid, and, in the processes for iodide and bromide of potassium, to reduce the iodate or bromate formed to iodide and bromide respectively.

*In Medicine.*—Principally employed as a deodoriser, disinfectant, and absorbent. For example, when exposed in open pans in a dissecting room, it tends to remedy the unpleasant odour, and, if a little be added to a cask of water, intended for a long voyage, or, better still, if the interior of the cask be charred, it will preserve it sweet.

*Internally*, it is chiefly used as an absorbent and deodoriser in certain gastric complaints attended with fetid breath and eructations, or with sour discharges, e. g. pyrosis. It will sometimes relieve obstinate vomiting, and may be advantageously given in flatulent diarrhœa and dysentery. The average dose is a teaspoonful; it may also be given in the form of biscuits or lozenges.

*Externally*, a Charcoal Poultice, frequently renewed, is an excellent application to foul and gangrenous sores. A mixture of equal parts of charcoal and prepared chalk forms one of the best tooth-powders for whitening the teeth. Charcoal respirators

are used as protectives against poisonous gases, and charcoal filters are adapted to the purification of water.

### CARDAMOMUM.\*

*Origin.*—Cardamoms are the seeds extracted from the capsules of *Elettaria Cardamomum*, N.O. Zingiberaceæ. The ripe fruits are picked in November, gently dried, and separated by rubbing with the hands from the footstalks and adhering calyx. Several varieties of the fruit exist, and are designated in commerce, *shorts*, *short-longs*, and *long-longs*.

*Characters.*—The fruit is a three-celled capsule containing many seeds, and is about  $\frac{1}{2}$  an inch long, with three rounded angles. The seeds, which form  $\frac{3}{4}$  of the total weight, are easily distinguished from other seeds, e. g. colchicum, by their angular shape, aromatic odour and taste, and comparative softness. The pericarps (i. e. fruit wall) being much less aromatic than the seeds are rejected from medicinal use. The aromatic qualities depend on the presence of a colourless volatile oil,  $C_{10}H_{16}$ , amounting to 4.5%. The seeds should be powdered only when wanted for immediate use.

*In Medicine.*—A pleasant cordial aromatic much used as an adjuvant or corrective of tonic, purgative, and other medicines. The Tinct. Card. Co. possesses a fine red colour, and makes an elegant addition to many prescriptions.

### CARUI† FRUCTUS.

*Origin.*—The dried entire fruit of *Carum Carui*, N. O. Umbelliferæ, from which are derived all the small aromatic fruits.

*Characters.*—The appearance of the little fruit, often incorrectly termed seed, is familiar to every one, and the curved,

\* *Κάρδαμον*, cress; and *Ἄμωμον*, ginger; as partaking of the nature of both of these plants.

† *Carvi*, or *Carvia*, Arab.



sharply-pointed form, together with the odour and taste, easily distinguish it from somewhat similar fruits. Usually only the half fruits (mericarps) are met with, as they readily separate. Their aroma is due to 4 or 5% of a yellowish volatile oil, a mixture of carvene ( $C_{10}H_{16}$ ) and carvol ( $C_{10}H_{14}O$ ). The oil enters into Conf. Scammon. and Pil. Aloes Barbadosensis.

*In Medicine.*—Mainly used as an agreeable adjuvant to other preparations, and the oil, in small doses, m. i.-ij., is a pleasant stomachic and carminative, in flatulent colic, &c. Caraway water may be given freely in ounce doses.

### CARYOPHYLLUM.\*

*Origin.*—Cloves† are the dried *unexpanded* flower-buds of *Caryophyllus aromaticus*, N. O. Myrtaceæ, a small and graceful ever-green tree, originally limited to the Molucca Islands, but now cultivated extensively elsewhere. If the flower-bud be fully expanded, it loses its aromatic qualities altogether. The best cloves come from Amboyna, and are imported in bags or casks.

*Characters and Tests.*—Their appearance is quite characteristic, viz.: that of a round-headed nail, about half an inch long, with four spreading teeth. The body of the clove consists of a tubular calyx surmounted by four teeth; the round head is formed by the four unexpanded petals, within which are four clusters of stamens. This is easily demonstrated by macerating a few cloves in warm water.

The best cloves are large, heavy, and should, like nutmeg, give out a streak of oil on being scored with the nail. When light, wrinkled, yellowish, and of feeble taste and smell, they are of inferior quality. Their most important constituents are about 18% of a volatile oil, one of the few which is heavier than

\* *Κάρυον*, a nut; *φύλλον*, a leaf; for it was supposed to be derived from the Indian nut-plant.

† French, *clou*, a nail.

water, and a variety of tannin. The oil contains a liquid hydrocarbon,  $C_{10}H_{16}$ ; eugenic acid,  $C_{10}H_{12}O_2$ ; eugenin, a solid isomer of the acid, and another crystalline substance, caryophyllin,  $C_{10}H_{16}O$ , isomeric with laurel camphor. The infusion and oil of cloves are reddened by nitric acid, and turned blue by ferric chloride, giving in fact colours similar to those obtained from morphia. Infusion and oil of pimento are similarly affected.

*In Medicine.*—A stimulant aromatic and tonic, chiefly used as an addition to other medicines. The oil is a popular remedy for the pain of a carious tooth. On account of the presence of tannin all preparations of cloves discolour salts of iron.

### CASCARILLÆ\* CORTEX.

*Origin.*—It is the bark of Croton Eluteria† N. O. Euphorbiaceæ, a small shrubby tree possessing very fragrant white flowers.

*Characters.*—The small fragmentary quills, with the adherent white patches of lichens, the warm taste, and aromatic odour, rendered more distinct by friction or heat, sufficiently distinguish it from other barks. It most nearly resembles some of the varieties of Cinchona Pallida, but the Infusion does not give a precipitate with Tinct. Gallæ. The bark contains a crystalline principle, *cascarillin*, and a volatile oil.

*Copalchi bark*, derived from Croton Pseudo-china has been confounded both with true Cascarilla bark, and with Pale Cinchona.

*In Medicine.*—An agreeable aromatic tonic without decided bitterness. An acceptable prescription for a tonic mixture suitable to convalescence from fever, certain cases of dyspepsia, and chronic diarrhœa, is:  $\mathcal{R}$  Infus. Cascar.  $\mathfrak{z}$ vij., Ac. Nitro-hydrochlor. Dil.  $\mathfrak{z}$ ij., Tinct. Cinch. Co. i. Dose  $\mathfrak{z}$ ss. to  $\mathfrak{z}$ i.

\* Dim. *cascara*, a bark, Spanish.

† Abundant in the Island of Eleuthera, one of the Bahamas.

On account of its odour, it is sometimes mixed by smokers with their tobacco, and is said to be then apt to affect the head.

### CASSIÆ PULPA.

*Origin.*—The sweetish pulp obtained from the pods of Cassia\* *Fistula*, N. O. Leguminosæ, a large tree, a native of India and Egypt. The fruit consists of long, cylindrical, dark brown, hard pods or legumes marked with two or three longitudinal bands, something like the stripes on the large intestine.

The legumes, or more strictly loment, i.e. indehiscent legumes, are from one to two feet long, about the thickness of the thumb, with numerous transverse partitions or diaphragms within, thus forming a number of cells, each containing a soft black pulp, and a single oval, shining brown seed. The pulp is extracted by bruising the pods, then boiling them in water, and afterwards evaporating the decoction.

*Characters.*—A sweet soft pulp with a faint, sickly odour and taste. It contains about 60% of cane sugar.

*In Medicine.*—Mildly laxative, and used only as an ingredient in senna electuary in which it is quite superfluous.

### CASTOREUM.†

*Origin.*—On the under surface of the abdomen of the beaver, *Castor Fiber*, Ord. Rodentia, are, in both sexes, two pairs of membranous sacs, of which the lower and larger are pear-shaped, and contain an oily, viscid, highly odorous substance, which is castor. The resinous secretion is derived from glands, which lie externally to the follicle. When the follicles are removed they are dried either by smoke or in the sun. Castor was anciently considered to be the testicles of the beaver which

\* Not to be confounded with Cassia bark, or false Cinnamon, N. O. Lauracæ.

† Κάστωρ, the beaver.

the animal bit off when pursued. American castor, indeed, has very much the appearance of a pair of dried testicles united by their spermatic cords. Unfortunately for the story the castor sacs occur in the female also.

*Characters.*—The follicles, which are often unequal in size, are united in pairs by their excretory ducts, and are divided internally into numerous cells. The castor sometimes brought from Russia is larger and heavier than the American castor, and effervesces with hydrochloric acid. Castor is said to contain a little carbolic acid, as well as salicin, which is probably derived from the willow and poplar upon which the beaver feeds. But its chief constituent is a resinous matter termed *castorin*. A fraudulent imitation of castor is sometimes effected by stuffing a goat's scrotum with a mixture of various drugs scented with genuine castor.

*In Medicine.*—A nervous stimulant and antispasmodic, but it is little used and less needed. The Tincture, which is of a deep red colour, gives an opaque-yellow precipitate when diluted with water.

### CATAPLASMATA.\*

A cataplasm or poultice is a moist soft substance intended for external application. It should be light, and of such a consistence as to adapt itself accurately to the surface to which it is applied without being so liquid as to spread beyond the required distance, or so tenacious as to adhere too firmly to the skin.

The so-called "galvanic poultices" of Recamier consist of two layers of spangles of zinc and of copper imbedded in cotton wadding and covered on one side with an impermeable coating. The acid of the perspiration is supposed to excite them electrically, but they are quite useless.

\* Καταπλάσσω, to overlay with plaster.

Poultices are commonly ordered with reference to a sedative or emollient (C. Lini, C. Conii), stimulant (C. Sinapis), or deodorising (C. Carbonis, C. Sodæ Chloratæ) effect, the two latter objects not being incompatible.

With a view to the first named effect it is well to bear in mind that the prolonged application of moisture, especially when conjoined with warmth, is very depressing to the nutritive and reparative powers of the tissues, as is often seen when poultices are kept too long in contact with an ulcer or an opened abscess, for the skin becomes sodden, the structures infiltrated with water, small pustules are brought out, and all disposition to heal is at an end. Various substances, in addition, may be incorporated with a poultice, or sprinkled on its face, with great advantage, e. g. Tinct. Opii, Permanganate of Potash, &c. Of the six official Cataplasmata, all are prepared with linseed meal as their basis, or *corpus*, except C. Fermenti, and, in C. Carbonis, bread-crumbs are superadded. Boiling water is used in every case except C. Fermenti.

Spongio-piline, a felted material of wool and sponge coated on one of its surfaces with caoutchouc, if soaked with warm water, makes a clean and efficient substitute for a poultice when warmth and moisture are required, and it may also be made a recipient for lotions and liniments.

### CATAPLASMA CARBONIS.

Sometimes applied to fetid and gangrenous ulcers, the charcoal having the power of absorbing gases and noxious emanations. The bread-crumbs makes the poultice more porous, and half the charcoal is purposely sprinkled on the surface of the poultice so as to obtain the maximum effect.

### CATAPLASMA CONII.

This may be advantageously employed as a sedative and anodyne application to cancerous and other painful sores

## CATAPLASMA FERMENTI.

The yeast or fermenting poultice owes its virtues mainly to the carbonic acid gas developed by the action of yeast on flour at a gentle heat. The extricated gas causes the mass to rise. Water at a higher temperature than 100° would tend to arrest the fermentative process.

This poultice is employed as a gentle stimulant to ill-conditioned sloughy ulcers, and is thought to hasten the separation of the slough.

A boiled-carrot poultice is often a very excellent application to foul ulcers, and seems to answer to some extent to a yeast poultice.

## CATAPLASMA LINI.

The common emollient poultice used to promote suppuration or relieve inflammation. Some olive oil is added to replace the oil which had been previously expressed from the linseed before it was ground into meal, which alone would be too dry and sticky. The addition of a little bran prevents the poultice from being too tenacious. A common bread and milk poultice is sometimes more acceptable to a tender or irritable skin.

## CATAPLASMA SINAPIS.

Warm water is preferable to boiling water, for the latter interferes with the development of the acrid volatile oil by coagulating the myrosyne. (See Sinapis.) The addition of vinegar is sometimes erroneously considered to increase its efficiency; in the case of black mustard seed it actually diminishes its rubefacient power. This was known to Aetius:—*Acetum enim sinapis vim discutit.*

In common use, under the name of *sinapism*, as a speedy and powerful counter-irritant and stimulant. A sense of warmth is



excited by it in a few minutes, while in half an hour or so the pain frequently becomes insupportable. Individuals vary considerably in their susceptibility to its action; but in all cases care should be taken that the poultice should not be allowed to remain on too long, for troublesome and dangerous vesication, and even gangrene may result. This caution is particularly necessary in cases of insensibility, and in children and old people; for, at the extremes of age, there is comparatively little power of resistance.

### CATAPLASMA SODÆ CHLORATÆ.

An useful deodorising and stimulant application to indolent or gangrenous sores.

### CATECHU\* PALLIDUM.

*Origin.*—In the Pharmacopœia for 1864, two different kinds of catechu were recognised, viz., Catechu nigrum, an extract from the wood of *Acacia Catechu*, N. O. Leguminosæ, and Catechu pallidum, an extract from the leaves and young shoots of *Uncaria Gambir* N. O. Cinchonaceæ (Rubiaceæ). The latter alone is now officinal, and is prepared by boiling the leaves and young shoots in water, and evaporating the decoction to a proper consistence, when it is spread out into flat cakes, and cut into small cubes.

*Characters and Tests.*—The brick-red porous cubes, dark brown on the outside, are quite characteristic of this drug. From its earthy appearance it was formerly called *Terra Japonica*. The native name by which it is often known in this country, is *gambir*. Sp. gr. 1·390. The astringent taste depends on the presence of a variety of tannin, 28 to 55%, which gives a greenish precipitate with ferric salts, and does not precipitate

\* Japanese, *kate*, a tree; *chu*, juice.

tartar emetic. Catechuic acid (catechin) is also present, and possibly the tannic acid is a product of its decomposition. The astringency is destroyed by alkaline salts. It is mostly, i. e. 60% soluble in cold water, and entirely so in boiling water. Sago, or other starchy matter, is sometimes used to adulterate it; in such a case iodine will render the cold decoction blue.

*In Medicine.*—A tonic astringent occasionally used locally in relaxation of the throat, in epistaxis, &c., but chiefly employed for the same purposes as kino and rhatany, viz., in passive diarrhœa and hemorrhage. The Pulv. Catechu Co. comprises these three vegetable astringents. The Tincture, which, like Tinct. Kino, sometimes gelatinises when kept, is frequently added to other astringent vehicles, and may be given in doses of 3ss. to 3i.

### CERA\* ALBA.

*Preparation.*—Yellow wax, melted and spread out in thin layers, is exposed for several days to the combined influence of air, light, and moisture. The process, if necessary, is repeated, and the wax, when sufficiently white, is melted and cast into small circular cakes.

*Characters.*—Pure wax (virgin wax) is yellowish white; if perfectly white, it contains spermaceti, added to improve its colour. Sp. gr. 0.966. If unctuous to the touch the presence of fatty adulterations (tallow, suet, lard) would be indicated. Its melting point is 10° higher than that of yellow wax. The sp. gr. and point of fusion are lowered by admixture with tallow, suet, or lard; but it is not a very easy matter to detect the various frauds practised upon wax.

*In Pharmacy.*—See Cera Flava.

\* Κηρός, wax.

## CERA FLAVA.

*Origin.*—Wax is a proper secretion of the bee, and is not merely collected from the plants visited by the insect. It is obtained by melting the comb, freed from the honey, in boiling water; when the liquid cools the wax concretes, and after removal, is re-melted, and poured into suitable moulds.

Many plants also yield wax, some in considerable quantity, and a good deal of Chinese wax (*Fraxinus chinensis*), and of Japanese wax (*Rhus succedaneum*) is now imported for use; while myrtle wax (*Myrica cerifera*) is employed in America.

*Characters and Tests.*—Its distinctive odour and appearance are familiar, and it cuts in such a manner as to leave a peculiar smooth, glossy surface, specially known as a “waxy” appearance. Yellow wax presents a granular surface when fractured. Sp. gr. 0.96 to 0.965.

Wax is insoluble in water (starch would be removed by boiling water), in cold alcohol (which takes out resinous matters), and in ether. It is readily soluble in volatile and fixed oils, e. g. Charta Epispastica, and is saponified by alkalies. It combines by fusion with fats and resins, and is therefore employed in the preparation of plasters and ointments, to which it imparts due consistence and tenacity. Oil of turpentine or benzine are the best solvents; any starchy or earthy impurities would be left behind. The melting point of yellow wax is  $10^{\circ}$  below that of white wax. Wax is a mixture of three bodies, viz., Free cerotic acid (cerin),  $\text{HC}_{27}\text{H}_{53}\text{O}_2$ , soluble in boiling alcohol, 22%; Palmitate of melissyl (myricin),  $\text{C}_{30}\text{H}_{61}$ ,  $\text{C}_{16}\text{H}_{31}\text{O}_2$ , almost insoluble in boiling alcohol, 73%; and Cerolein, soluble in cold alcohol, and to which the colour, odour, and tenacity of the wax are due, 5%. A curious *black* wax of unknown origin, imported from Madras, which I subjected to analysis, was remarkable in yielding more than 60% of crude cerotic acid, 15% of cerolein, the

place of the myricin being occupied by 21% of colouring matter (*Journ. Roy. Dubl. Soc.*, 1868).

*In Pharmacy.*—Yellow or white wax occur in five of the fourteen Emplastra, and, directly or indirectly, in eighteen Ointments. The term *cerate* was formerly applied to ointments containing wax, but it is now disused. Wax forms the basis of Blistering Paper, and of some of the Suppositories, and enters into the new *Pilula Phosphori*.

*In Medicine.*—Seldom used internally, but has been prescribed occasionally in diarrhoea and dysentery.

### CEREVISIÆ\* FERMENTUM.

*Origin.*—Yeast or barm is essentially a fungus, and forms the frothy substance which rises to the surface during the fermentation of saccharine liquids, e. g. in the manufacture of beer. As the fermentation goes on, the yeast plant (*Torula cerevisiæ*) undergoes active multiplication at the expense of the fermenting substance.

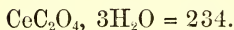
*Characters.*—A dirty-yellow, flocculent, frothy substance, possessing a sour, vinous odour, and a bitter taste. In a warm place it soon undergoes putrefaction, but, when carefully dried, it can be preserved for a long time. It is insoluble in alcohol or water.

*In Pharmacy.*—It is the essential constituent of the yeast poultice. Occasionally it is used for the purpose of causing fermentation, e. g. in the estimation of sugar in diabetic urine by the amount of carbonic acid gas evolved.

*In Medicine.*—A tonic stimulant, especially praised in typhus and typhoid fever, and other adynamic states of the system. Externally, it is a deodoriser and gentle stimulant to foul and sloughing ulcers. Dose: half an ounce, diffused in some aromatic water, e. g. *Aq. Menthæ Piperitæ*.

\* A contraction of *Cerereis vis in aqua*.

## CERII OXALAS.



*Origin.*—It is derived from the mineral *cerite*, a silicate of iron, calcium, and of the three rare metals, cerium, lanthanum, and didymium. Its mode of preparation need not be given here.

*Characters and Tests.*—When heated strongly it yields a brown residue of oxides of cerium ( $\text{CeO}$ , and  $\text{Ce}_2\text{O}_3$ ). Pure oxide of cerium is white, and the colour of the residue is due to the presence of didymium. This residual oxide is completely soluble in boiling hydrochloric acid without effervescence (absence of earthy oxalates and of carbonates), and the resulting solution gives with sulphate of potash a white precipitate of double sulphate of potassium and cerium,  $\text{K}_2\text{Ce}_2\text{SO}_4$ .

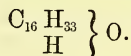
The addition of sal ammoniac to the filtered potash solution would precipitate any alumina if present, and chloride of calcium in the acetic solution detects the oxalic acid radical by giving with it a white precipitate, insoluble in acetic acid (thus distinguished from calcic phosphate), but soluble in hydrochloric acid.

*In Medicine.*—Introduced in 1854 by the late Sir J. Simpson as a gastric sedative, especially in the vomiting of pregnancy. It is occasionally employed in other affections, e. g. chorea and epilepsy, but it has scarcely maintained its place as a trustworthy remedy. It does not blacken the skin as nitrate of silver is liable to do. Given in pill, in doses of one or two grs.

## CETACEUM.\*

*Origin.*—In the upper part of the enormous head, thirty feet in circumference, of the cachalot or sperm whale, *Physeter macrocephalus*, Ord. Mammalia, are large cavities, containing an oily liquid, which, after death, concretes into a white spongy mass, consisting of spermaceti mixed with sperm oil. Some spermaceti is also contained in other parts, as the blubber. The spermaceti is separated from the oil, and other impurities, by expression, washing with hot water, melting, straining, and repeated washing with a weak alkaline ley. Ambergris is also probably derived from the sperm whale.

*Characters and Tests.*—The white lustrous pearly masses are quite characteristic. Sp. gr. 0.943; fusible at 112° F. Insoluble in water, and, like camphor, it cannot be powdered except by the addition of a little rectified spirit or almond oil. Admixture with ordinary fats, e. g. lard or suet, would lower its melting point. It is soluble in volatile oils, fixed oils, and melted fats. Chemically pure spermaceti, or cetine, is a peculiar variety of fats, and is strictly a compound ether, viz., palmitate of cetyl,  $C_{16}H_{33}$ ,  $C_{16}H_{31}O_2$ . When saponified, therefore, it does not, like ordinary fats, yield the triatomic alcohol, glycerin, but a monatomic compound, cetylic alcohol or ethal—



*In Pharmacy.*—Forms an ingredient of Blistering Paper, and of Spermaceti Ointment. It is stated that red oxide of mercury alters less with this ointment than with lard.

*In Medicine.*—Has been recommended in inflammatory affections of the pulmonary and intestinal mucous membranes; but its internal use is now abandoned.

\* *Cetus*, a whale. Named *sperma-ceti* from an old superstition that it constituted the seminal fluid of the animal.



## CETRARIA.\*

*Origin.*—A native of the higher northern latitudes of the old and new continents, and found also in Britain; but it abounds particularly in Iceland. It grows upon the bark of trees, and on the ground. It is an error to term it a *moss*, for it belongs to a much lower class of cryptogamous plants, viz., Lichens.

*Characters.*—The whole plant, which is officinal, is from two to four inches high, with a dry, smooth, and irregularly divided frond, or leafy structure, fringed at the edge with rigid hairs. The fructification is in flat, peltate, reddish receptacles, placed upon the frond near its border. Cetraria contains a large quantity, 44%, of a starchy principle, termed *lichenin*, and another allied substance, *inulin*, and hence a strong decoction thickens on cooling. Lichenin is turned blue by iodine; inulin is not. The bitter taste is due to 3% of *cetraric acid* (cetrarin),  $\text{H}_2\text{C}_{34}\text{H}_{30}\text{O}_{16}$ , of which it may be deprived by maceration in water, or, better still, by a weak alkaline solution. Boiling water takes up about 65% of its substance.

*In Medicine.*—Chiefly used in chronic catarrhal complaints as a nutritive and demulcent non-astringent tonic; but it has no specific influence in pulmonary diseases. In Lapland and Iceland it is used as an article of food. Cetraric acid has been recommended as a substitute for quinine.

## CHARTA EPISPASTICA.

A fatty and resinous solution of cantharides spread upon paper. The name is adopted from the French Codex.

*In Medicine.*—A convenient substitute for the less elegant Empl. Canthar. (fly blister). The side coated with the blistering

\* *Καίρρα*, a leather shield, from the form of its frond.

compound should be kept covered with fine paper, to be removed just before application, and the surface of the skin should be slightly greased before putting it on, so as to ensure close contact. For an account of its uses, see Cantharis.

### CHARTA SINAPIS.

Paper smeared on one side with a mixture of powdered black mustard seeds, and solution of gutta percha. It is an imitation of Rigollot's mustard leaves, and is an elegant mode of applying a sinapism. Before use the paper must be dipped in warm water.

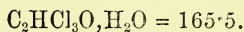
### CHIRATA.

*Origin.*—Chiretta is the whole plant of *Ophelia Chirata*, N.O. Gentianaceæ, and is gathered when the flowers begin to decay.

*Characters.*—The dried plant is imported in bundles about three feet long, consisting mainly of the stems, with portions of the root attached. Like all Gentians, the entire plant, especially the root, is intensely bitter. It contains *ophelic acid* and *chiratin*, a very bitter resinous substance.

*In Medicine.*—A pure bitter tonic, long and extensively used in India, but never much employed in this country. It has been given in dyspepsia, convalescence from acute diseases, and in malarial fevers, and in fact possesses similar properties to gentian.

### CHLORAL\* HYDRAS.



This remarkable body which was discovered by Liebig, in 1831, almost contemporaneously with chloroform, was an object of

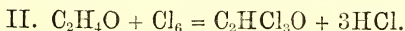
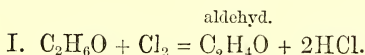
\* *Chlorine*, and *alcohol*, from its mode of preparation.

purely chemical interest for nearly forty years, and has since its announcement as a therapeutic agent in 1869, by O. Liebreich, of Berlin, attracted largely the attention of physiologists and practical physicians. Chloral is now made by the ton, and can be had at a moderate price, but in 1870, £3 15s. was paid for 2 oz.

*Preparation.*—Pass a stream of dry chlorine gas through *anhydrous* alcohol for several days continuously. By this means anhydrous chloral, a dense, oily, pungent liquid, is obtained in a crude form, and is purified by treatment, first with sulphuric acid, which retains water and any unchanged alcohol, and afterwards with a little quicklime which seizes on and fixes the free hydrochloric acid which is produced.

By the addition of a small quantity of water, the liquid chloral is converted with extrication of much heat into the solid hydrate, the officinal drug, commonly called chloral.

The fundamental equations of this process theoretically occur in two stages :—

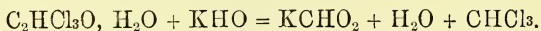


Although aldehyd can be regenerated from chloral by nascent hydrogen, the converse reaction has not as yet been actually effected, croton-chloral being the product of the action of dry chlorine on aldehyd. Thus chloral corresponds to aldehyd with  $\text{H}_3$  replaced by  $\text{Cl}_3$ , or it is tri-chlor-aldehyd, and chloral agrees with aldehyd in several particulars. In reality the theory of the process is not so simple. Subordinate and complicated interchanges go on at the same time which result mainly from the influence of the  $\text{HCl}$  and of the  $\text{Cl}$  on the substances produced, and on the impurities in the spirit, and a long list of by-products is thus formed.

Much impure chloral circulates in the market, and Liebreich

states that he has in his possession a collection of horrible chemical mixtures sold under the name of chloral, which he would not venture to give to a human being. Nearly all the chloral is prepared in Germany.

*Characters and Tests.*—Commercial specimens are often like loaf-sugar in small entangled crystals. Perfectly pure chloral can be obtained in transparent crystals about the average size of fine Epsom salt crystals. The form of the crystals varies with the liquid from which they are crystallised. Chloral is hygroscopic, and is extremely soluble in water. The odour of the drug has been not inaptly compared to that of a ripe melon, and its taste is irritating and caustic. Chloral is remarkably resistant to acids. Although fuming nitric acid attacks it, nitric acid of sp. gr. 1·2 has little or no action upon it. Sulphuric acid simply dehydrates it, and liquid chloral separates, which, after a time, becomes partially opaque from the formation of an insoluble isomer, termed *metachloral*, which has been used externally as a caustic. But caustic alkalies exert a powerfully decomposing influence over it, and split it up into chloroform and alkaline formate.



i.e. 165·5 grs. of chloral yield 119·5 grs. of chloroform, or, 72%. Hydrate of chloral contains 90% of anhydrous chloral.

This reaction is considered by Liebreich and his followers to be the keystone to the physiological action of chloral. Alkaline carbonates and bicarbonates cause a similar change but more slowly, unless heat be applied.

Chloral combines with alcohols, and an alcoholate of chloral has been substituted for the true chloral hydrate. The (ethylic) alcoholate is much less soluble in water than the hydrate, has a higher boiling point, and yields 10% less chloroform. For the direct detection of alcohol in chloral Lieben's iodoform test is the best. (See Spir. Rectif.) Rubbed up with an equal

weight of camphor, a syrupy liquid is produced which has been used as a local anæsthetic. It is of the utmost importance that chloral should be free from chlorinetted impurities, which are very deleterious. Pure chloral should be neutral or nearly so to blue litmus paper; its clear aqueous solution should not precipitate with nitrate of silver, it should not be discoloured by sulphuric acid, and it should boil below  $212^{\circ}$ . Some specimens of chloral appear to contain croton-chloral. (See Croton-Chloral.)

The best test of the quality of chloral is the amount of chloroform it will yield when distilled with alkalis, and the officinal "lime process," (Wood) requires that pure chloral, treated as directed, should yield at least 70% of chloroform by weight.

Various other quantitative tests have been proposed, but the one just mentioned is simple and accurate. Chloral attacks cork, paper, and even india-rubber, but is without action on metals. It possesses antiseptic and preservative qualities in a high degree, and may be used in the conservation of anatomical preparations.

*Theory of its Action.*—Much controversy has been spent on this question, and three theories have been put forward:—

1. *Liebreich* introduced chloral into therapeutics on the supposition that it would be decomposed by the alkaline blood, and he believes that chloral acts entirely through the nascent chloroform produced. This may be termed the chemico-physiological theory, and is supported by Richardson, Personne, Bussy, and others.

2. *Gamgee and Gubler.*—Chloral acts as such without undergoing any decomposition. This is the doctrine of the autonomy of chloral, and is supported, among others, by Labbé and Demarquay.

3. *Byasson.*—Chloral possesses an action peculiar to itself, and distinct from that of chloroform. It may be considered

as the resultant of the actions of the chloroform and formic acid slowly liberated within the organism in the nascent state.

The third theory is only a modification of the first, which is that generally received and taught. But forcible objections, chemical, physiological, and clinical, can be urged against it, and the hypothesis of the peculiar effects of chloral being due to nascent chloroform is both gratuitous and unnecessary. If any chloral is decomposed in the system it is only a small proportion.

*Physiological Action.*—Chloral is a pure hypnotic, and, in full doses, especially when injected into the veins, causes anæsthesia, but it is not likely to supersede chloroform or ether in the performance of capital operations. During the hypnotism there is a reduction of temperature, and complete muscular relaxation. Chloral, as a hypnotic, is particularly distinguished by rapidity of action, this effect taking place in from five to thirty minutes. The sleep is generally tranquil and light, and patients, on awaking from it, seldom experience any bad results such as often follow opium. Chloral appears to be eliminated partly by the lungs, and partly by the kidneys, and the urine of chloralised persons reduces (Fehling's) cupro-potassic solution, which has given rise to the erroneous statement that such urine contained sugar. The cause of this reduction appears to be the presence of a little formate of sodium.

*In Pharmacy.*—The Syrupus Chloral contains ten grs. in 3i.

*In Medicine.*—*Local Effects.*—Chloral is irritant, and the solid hydrate, or even strong solutions, will cauterise the skin. Pencils of chloral and of metachloral have been recommended as caustics and solutions of chloral have been applied as a dressing to atonic ulcers, gangrene, phagedenic chancres, and scrofulous lupus.

*General Effects.*—The principal therapeutic uses of chloral fall conveniently under the following heads :—



(a.) *Muscular spasm*.—Although good results were anticipated from the use of chloral, in tetanus especially, the verdict of experience is not very encouraging, and, on the whole, its failures are more conspicuous than its successes. It has also been tried in chorea, and in rigidity of the os uteri. The alleged antagonism of chloral and strychnia does not appear to be well founded, although the painful spasms of strychnia-poisoning in man can be mitigated by chloral. The paroxysms of asthma, the spasmodic fits of whooping cough, and the convulsions of childhood, often yield with facility, or are greatly reduced by the judicious use of chloral.

(b.) *Pain*. Liebreich expected that chloral would prove indispensable in the treatment of inflammatory painful affections, and it has been used in articular rheumatism, gouty pains, nephritic and hepatic colic, angina pectoris, and aneurismal pain, various forms of neuralgia, abscess, and even cancer, with remarkable anodyne and soothing effects. On the whole, its anodyne powers seem to be subordinate to its hypnotic powers, and to be less certain in their operation. In midwifery, chloral lends valuable aid; under its full action the parturient uterus continues to contract regularly and strongly. It may be given with safety during the first stage of labour, and it need not interfere with the after-use of chloroform.

(c.) *Hypnotic and Nervous Sedative*.—The sleep which chloral induces is not, as a rule, preceded by the stage of excitement so well known under chloroform inhalation, and chloral is particularly serviceable in cases where patients cannot tolerate opium in any form. The chief indication for the use of chloral is in all cases where the induction of sound and refreshing sleep is the principal object to be gained. For example, in delirium tremens, puerperal mania, the eclampsia of uræmia, and of the puerperal state, acute mania, and excitable cases of insanity generally. In the cerebral excitement incident to continued fever, chloral is often of great and immediate service in bringing

on sleep, and the sedative effects of chloral have also been utilised in the treatment of epilepsy and chorea.

*Poisoning by.*—The practice of resorting to chloral as a hypnotic in the absence of medical advice and direction, has of late become dangerously common, and several deaths have been occasioned by this cause. The sleep produced by chloral is occasionally dreamy and disturbed, and, in a few cases, patients, after a dose of forty to fifty grs. have been thrown into a state of extreme prostration, with gasping respiration, weak intermitting pulse, intense flushing of the face, and temporary loss of power over the limbs. Exceptionally, an urticarious or papular scarlatiniform eruption has appeared.

So many deaths have resulted from the improper or injudicious use of chloral that it is most important to be awake to a sense of its powers for harm as well as for good.

The graver degrees of acute *chloralism* are evinced by such symptoms as, paleness, disturbance of vision, cold sweats, feebleness and depression of pulse, stupor, mydriasis, œdema of face and body, and tetanoid convulsions ending in death.

There is no true antidote to chloral, and the treatment to be adopted consists in the administration of an emetic followed by stimulants.

In chronic chloralism, phenomena resembling those of ergotism have been met with, viz., hyperæsthesia, general *malaise*, desquamation of the cuticle of the fingers with superficial ulceration around the nails, anasarca, albuminuria, enfeeblement of the heart, and oppression of respiration, purpura, and ulceration of the mucous membranes.

*Contra-indications.*—Liebreich points out the following:—Extensive destructive affections of the mucous membrane of the digestive tract, arthritic conditions, and hysteria. In typhus fever, and in affections of the circulatory apparatus, particularly in serious valvular disease of the heart, small doses should be prescribed, as well as in all cases of extreme debility, and especially in progressive general paralysis.

*Dose and Administration.*—The average dose as a hypnotic, for an adult is about 20 grs., and, as a nervous sedative, it is better to give it in smaller divided doses. In exceptional cases, e. g. tetanus, and delirium tremens, much larger doses may be required.

Chloral being soluble in water, alcohol, ether, and glycerin, a multitude of formulæ have been proposed with the object of disguising the unpleasant flavour of the drug, and, in every case, it should be the invariable rule to give it freely diluted. Some aromatic syrup, e. g. tolu, lemon, or orange, may be appropriately added, or the Extract. Glycyrrh. Liq., along with a cordial water, e. g. Aq. Menth. Pip., or, emulsion of sweet almonds.

Chloral is liable to decomposition by contact with organic matter.

Gelatin capsules and *dragées* have been recommended in France, but are objectionable on account of bringing the chloral into contact with the stomach in too concentrated a state.

Chloral has also been administered by enema in tetanus, but the injection is apt to cause scalding, and vaginal suppositories of chloral have been recommended in uterine cancers.

It was early proposed to administer chloral by hypodermic injection, but the bulk of the solution necessary and the risk of local inflammation are serious objections to this method. Lately, M. Oré has advocated the intravenous injection of chloral in tetanus, &c., but the propriety of this procedure is doubtful.

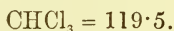


*CROTON-CHLORAL-HYDRATE.* (Not officinal.)

This interesting substance was accidentally discovered by Kramer and Pinner in 1870. It somewhat resembles chloral hydrate in appearance, but is sparingly soluble in cold water. By the action of alkalies it is split up into di-chlorallylene,  $\text{C}_3\text{H}_2\text{Cl}_2$ , and formic acid, and it bears the same relation to crotonic aldehyd, and to crotonic acid that common chloral does to acetic aldehyd and acetic acid.

It is a hypnotic like chloral, and its most remarkable effect is to produce anæsthesia of the fifth nerve. According to O. Liebreich the three indications for the use of this remedy are to be found:—(1.) In cases where hydrate of chloral is inapplicable on account of heart disease. (2.) In neuralgia within the district of the trigeminal nerve. (3.) In cases where very large doses of chloral are necessary to produce sleep. Croton-chloral may then be conjoined with the hydrate of chloral.

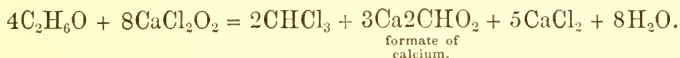
The dose is one or two grs. every hour, or five to ten grs. at a time, dissolved in water, and suitably flavoured.

*CHLOROFORMUM.*

*History.*—Chloroform was discovered almost simultaneously in 1831 by Guthrie of America, by Soubeiran in France, and by Liebig in Germany. At first it was erroneously termed “chloric ether.”

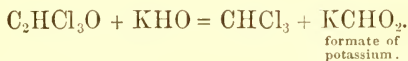
*Preparation.*—The officinal process (Soubeiran’s) consists essentially in gently heating diluted rectified spirit with chlorinated lime (bleaching salt). The slaked lime prescribed is not absolutely requisite, but is found useful in preventing secondary

decompositions. The reaction which occurs may probably be represented by the equation :—



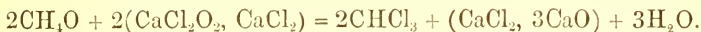
But this equation does not take into account the primary formation of chloral,  $\text{C}_2\text{HCl}_3\text{O}$ , which is generally believed to be first developed and then decomposed.

Chloroform can readily be obtained from chloral by treatment with alkalies :—



Chloroform may also be prepared from a number of other bodies, e. g. pyroxylic or wood spirit (methylic alcohol,  $\text{CH}_4\text{O}$ ), and it is now often obtained from methylated spirit, a mixture of 90% rectified spirit with 10% of wood spirit.

With methylic alcohol the reaction is,



When first distilled chloroform is very impure, and it is purified : (1) by washing the crude chloroform with water, which combines with, and separates alcohol or chlorine ; (2) by agitation with an equal volume of *pure* sulphuric acid, which chars and removes the oily impurities usually present ; (3) by distilling the chloroform, transferred from the acid on which it floated, off a mixture of dry chloride of calcium and slaked lime, which will retain any water present as well as any sulphurous acid derived from deoxidation of sulphuric acid.

*Characters and Tests.*—Chloroform is a neutral liquid, but sometimes spoils by keeping, and develops chlorine, and hydrochloric acid. When pure it neither bleaches nor reddens blue litmus paper. Its decomposition appears to be due to the use of impure sulphuric acid in purifying the crude chloroform, especially if the sulphuric acid contain any nitric or nitrous acid.

The addition of a little caustic soda preserves it from change by exposure to light.

It burns with difficulty with a *green* flame, producing hydrochloric acid, easily recognised by nitrate of silver. This result occurs with most chlorinated organic substances. It is scarcely soluble in water, but is readily soluble in oils, e. g. Linim. Chlorof., and, in spirit, e. g. Tinct. Chlorof. Co., and Spir. Chlorof., but the solution, if at all strong, e. g. one in ten, becomes turbid on dilution\* from separation of chloroform. Thus, from Tr. Chlorof. Co., when diluted, nearly half of the chloroform will separate and fall to the bottom.

Chloroform boils at 142° F., and hence, on account of its lesser volatility as well as for its more irritating qualities, unlike ether, it is not suited for producing local anæsthesia by refrigeration.

Extensive solvent powers are exercised by chloroform, e. g. over caoutchouc, gutta-percha (Liquor Gutta-percha), iodine, bromine, the alkaloids, most resins, fixed and volatile oils, and, generally, over bodies highly carbonised. It is also the best solvent for cholesterin and biliary calculi. As a menstruum it has the advantage over ether of being scarcely inflammable. The principal impurities of chloroform are:—(1.) Alcohol or ether, both of which lower its sp. gr. If either of these are present, the liquid, when heated with a little red (bi)chromate of potassium and sulphuric acid, will assume a green colour owing to reduction of the chromic acid to sesquioxide of chromium. (2.) Chlorinated oily compounds, produced in its preparation, detected by giving a dark colour on agitation with an equal volume of pure oil of vitriol, and by the unpleasant smell which they leave on evaporation. (3.) Hydrochloric acid, detected by nitrate of silver. When dropped into distilled water chloroform should fall to the bottom in *transparent round globules*.

*In Pharmacy.*—Used in the new Liquor Gutta-percha, and in the extraction of the mixed alkaloids from pale and red Cinchona



barks, cinchonia being insoluble in ether. Employed also in the preparation of Atropia, and, in testing Bromide of Potassium for bromine. In mixture it conceals the nauseous taste of many other medicines, mitigates the bitterness of certain drugs, and covers the odour of assafœtida. The new Aqua Chloroformi is a saturated aqueous solution. The Tincture is twice as strong as the Spirit. Spiritus Chlorof. is the officinal substitute for the older and uncertain medicine, improperly termed *chloric ether*, a name which has also been incorrectly applied to other bodies, e. g. chloride of ethyl, and to chloride of carbon. The *drops* of chloroform are very small, eight of them, on an average, equal two minims. It is, therefore, very necessary to avoid the common error of prescribing a “drop” as equivalent to a minim.

From chloroform are derived other anæsthetic compounds. For example, chlorine gas converts chloroform into *tetra-chloride of carbon*,  $\text{CCl}_4$ , a liquid, sp. gr. 1.5; proposed by Dr. Protheroe Smith as an anæsthetic.

Nascent hydrogen converts it into *bichloride of methylene*,  $\text{CH}_2\text{Cl}_2$ , a limpid liquid, sp. gr. 1.39, proposed by Dr. Richardson in 1867 as an anæsthetic. It acts rapidly and seems well suited for short operations.

All these bodies may be viewed as substitution compounds from marsh gas,  $\text{CH}_4$ , i. e. hydride of carbon, and they can all be obtained from it. It is possible to pick out the hydrogen of marsh gas atom by atom, and to replace it by chlorine, and so we get the series:—

$\text{CH}_4$	. . .	marsh gas.
$\text{CH}_3\text{Cl}$	. . .	chloride of methyl.
$\text{CH}_2\text{Cl}_2$	. . .	bichloride of methylene.
$\text{CHCl}_3$	. . .	chloroform.
$\text{CCl}_4$	. . .	chloride of carbon.

*In Medicine.*—Chloroform is (1) applied locally; (2) given by the mouth; (3) administered by inhalation.

Its topical action is that of an irritant, and the prolonged application of pure chloroform will cause vesication, and even sloughing. When diluted it causes rubefaction, and a lively sensation of heat.

*Externally.*—It has been chiefly used in neuralgia, itchy affections of the skin, and in painful and foul ulcerations. The vapour has also been locally applied. Added to other anodyne liniments, e. g. aconite or belladonna, it greatly assists their action, and promotes the absorption of alkaloids;  $\mathfrak{z}\text{i.}$  to  $\mathfrak{z}\text{i.}$  of the liniment is quite sufficient. A weak spirituous lotion is often serviceable, and, in the form of ointment, it may be incorporated with lard,  $\mathfrak{z}\text{i.}$  to  $\mathfrak{z}\text{i.}$

*Internally.*—It first stimulates, and produces symptoms of intoxication similar to those of the first period of alcoholism or etherism; then in large doses it stupefies, and gives rise to coma. As a sedative, narcotic, and anodyne, it is given to relieve spasm, pain, and irritation of the mucous membranes. Dose, 5 to 20 m., rubbed up with mucilage or syrup, or agitated with powdered gum. A combination of chloroform and opium is often more prompt and certain in operation than either agent given singly. Chloroform is an essential ingredient of the popular proprietary medicine, *chlorodyne*, the composition of which, following Mr. E. Smith's careful analysis is—Chloroform,  $\mathfrak{z}\text{iv.}$ ; Morph. Mur., gr. 20.; Ether, rectific,  $\mathfrak{z}\text{ij.}$ ; Ol. Menth. Pip., m. viij.; Acid. Hydrocy. Dil.,  $\mathfrak{z}\text{iv.}$ ; Tinet. Capsici,  $\mathfrak{z}\text{vi.}$ ; Mucil. Acaciæ,  $\mathfrak{z}\text{i.}$ ; Theriaca, ad  $\mathfrak{z}\text{iv.}$  No evidence of the presence of Indian hemp or of belladonna was obtained. The dark colour of commercial chlorodyne is due to caramel.

*Inhalation.*—First brought forward as an anæsthetic by the late Sir J. Simpson in 1847, sixteen years after its discovery.

*Preliminary Steps.*—The patient's bowels should be previously evacuated, a light meal taken *three or four hours before* the operation, and, if desirable, a little wine may be given a few minutes before the administration. When inhaling, the patient should

be in the recumbent position, and free from any constriction about the chest or neck.

The symptoms most usually arising during its inhalation may be arranged in three stages:—

*First Stage.*—Bronchial irritation, acceleration of pulse, slight intoxication, and diminution of sensibility.

*Second Stage.*—The patient falls into a dreamy state, often accompanied by considerable mental and muscular excitement; loss of common sensibility.

*Third Stage.*—Muscular relaxation, with complete unconsciousness and suspension of mental faculties, sometimes preceded by violent tonic spasm of all the muscles of the body. The iris is less sensitive to light, and moderately contracted. A simple test of the completeness of the anæsthesia is the insensibility of the conjunctiva to irritation, the lids not winking when touched. The anæsthetic condition may *with caution* be kept up for hours if necessary; and parturient women bear its effects in a peculiarly favourable manner. These symptoms are liable to considerable variation, and are notably modified by the habits and temperament of the patient.

All animals are sensible to its influence.

Chloroform is found in the blood, and in all the organs, especially in the liver and cerebral substance. It also passes into the secretions, even into the milk. The urine of persons subjected to chloroform and ether inhalation reduces Trommer's test as glucose does.

*Dose, and Methods of Administration.*—From ʒi. to ʒiv. usually prove sufficient, often in a few minutes, and it is essential that the chloroform be perfectly pure. The quantity required is, however, extremely uncertain. Numerous inhalers have been devised, but the most convenient is a handkerchief or thin towel twisted into the form of a cone. Since an atmosphere too highly charged with chloroform vapour is fraught with danger, Mr. Clover has invented an ingenious apparatus by which the patient

is made to inhale an atmosphere containing 4% of the vapour of chloroform, or any less proportion that may be desired. It consists (*a*) of a bag suspended at the back of the administrator, with the 4% mixture of air and chloroform vapour; (*b*) of a flexible tube connecting the bag with (*c*) the face-piece, provided with valves to prevent the expired air being re-breathed. In whatever mode chloroform is given, the pulse and the iris should be frequently and carefully examined.

*Signs of Danger.*—Chloroform proves fatal in one or other of two ways:—(1) By paralysing the muscles of respiration (asphyxia); (2) by paralysing the heart (cardiac syncope); the latter being the more frequently fatal. The alarming symptoms are: laryngeal stertor, shallow and irregular respirations, pupils fixed and dilated, pallor of the face, and failure of the pulse. In many cases, no doubt, the fatal accidents set down to chloroform are probably due, not so much to the concentration or quantity of the chloroform vapour, as to a peculiar and unknown susceptibility of its victims which it is impossible to foresee. The best *remedy* in serious cases is the steady use of artificial respiration. There is every hope so long as the pulse is perceptible, and even for some time after it has apparently ceased. In addition, it is advisable to sprinkle cold water on the face and chest, to draw forward the tongue, and to apply a feeble induced current, one pole at the side of the neck, and the other to the epigastrium.

*Disagreeable after-effects.*—Nausea, vomiting, and headache sometimes occur; and, more rarely, convulsions, abolition of smell, perversion of taste, and loss of power over the bladder and rectum.

*Contra-indications.*—It is doubtful how far valvular or even structural disease of the heart negative the administration of chloroform, but certainly greater caution is required in cases of fatty heart in old people, with weak and intermitting pulse, and, in short, in any condition that predisposes to syncope. It

may certainly be affirmed that no condition of age, sex, or temperament excludes the employment of anæsthesia for surgical purposes. It should never, on any account, be administered without the presence of a medical man.

*Compared with Ether.*—Chloroform does not appear to be so free from danger, but its advantages are: (1) it is more agreeable to the majority of patients; (2) it acts powerfully, rapidly, and in small doses; (3) it is less exciting; (4) it is more easily administered.

*Uses.*—Chloroform is very extensively employed in medicine, surgery, and midwifery. Pushed to the first stage only of its action, it is utilised in spasmodic and painful diseases, e. g. hiccup, hooping-cough, asthma, angina pectoris, colic, tetanus, and eclampsia with much advantage. Administered to the second stage, it is used in the relief of convulsive affections, muscular contractions and spasms, reduction of hernia, &c. In the third stage of its action, i. e. complete anæsthesia, it is in daily use in the performance of surgical operations.

#### CINCHONÆ\* FLAVÆ CORTEX.

#### CINCHONÆ PALLIDÆ CORTEX.

#### CINCHONÆ RUBRÆ CORTEX.

*History and Origin.*—Peruvian bark was introduced into Europe in 1640, but the botanical nature of the plants producing it was first determined by La Condamine, a French botanist, in 1737.

From its distribution and sale by the Jesuits after its introduction, it received and long retained the name of Jesuits' bark. Its earlier history, or the mode in which its virtues first became

\* Or properly, Chinchona. So named by Linnæus after the Countess of Chinchon, who, having experienced the beneficial effects of the bark in Peru, is said to have introduced it into Europe.

known, are matters of uncertainty. In the latter part of the seventeenth century its price was so high as £5 an ounce. When first made known it met with many detractors, and physicians who ventured to test its effects were exposed to persecution. "Religious and scholastic prejudices conspired to reject and condemn one of the most valuable discoveries recorded in the history of medicine" (Stillé). Sulphate of quinine was first used in England in 1823 by Dr. Elliotson.

The genuine *Cinchona* trees are confined exclusively to South America, extending in a curved zone along the Cordilleras from 10° north latitude to 19° south, and they grow at various elevations on the sides of the mountain ranges, seldom less than 4000 feet above the sea. They are tall shrubs or considerable trees, possess very fragrant and beautiful flowers, and belong to the N. O. *Cinchonaceæ* (*Rubiaceæ*). The foliage and other parts vary considerably according to the degree of elevation on the mountain slopes, and the climatic and other conditions; and there has been much discrepancy in the descriptions, and consequent doubt in the identification of the different species by botanists. The character of the product also of any one species varies according to the part of the plant stripped of its bark, and the circumstances of its growth. For example, if the red bark be cultivated at too great an altitude, it will not yield either quinia or quinidia; and if the pale or crown barks be cultivated below a certain altitude, the quinia will be replaced by cinchonidia and quinidia. Humboldt states that the valuable antiperiodic qualities reside in the bark of those *Cinchonas* only which possess hairy and woolly blossoms.

Within the last twenty years, and notably during the past decade, with a view to the preservation and multiplication of these valuable trees, numerous plantations of them have been established on the Nilgherry hills in South India, on the Himalayas, and in Java, Jamaica, St. Helena, and other places. The greatest success has attended this enterprise, which



was initiated by the Dutch in 1853, and has been warmly taken up, with the best results, by the English Government.

In the Indian plantations it has been discovered by Mr. M'Ivor that enveloping the trunk of the Cinchonas with moss ("mossing") for a considerable time, greatly increases the yield of alkaloids; and it has been found that if, instead of cutting down the tree, a strip only of the bark be taken off, and the wound covered up with moss, new bark is formed, which is *richer in alkaloids* than the original bark. This process of renewal may be carried on at intervals for several successive times. Exclusion of light by covering the trees with tinned plate, or black cloth, increases the amount of alkaloids more than 50%.

The bark is removed from the trees by natives, who are called *Cascarilleros*. A longitudinal incision is made through its whole thickness, and the bark is then forced off the stem or branch. The stronger stem-bark being dried under pressure occurs in flattened pieces, whilst the thinner branch-bark, being simply dried in the sun, rolls up, and so becomes *quilled*. The bark is imported in chests, or in large square packages, covered with ox hide, and termed *serons*.

*Characters*.—The classification of the barks usually adopted is based upon the peculiarities of colour which they exhibit in substance, or when powdered; and in the subjoined table their most important characteristics are placed side by side. The wood is nearly tasteless, but the bark of the root has the same properties as that of the trunk; and, according to De Vrij, the proportion of alkaloids in the root-bark of many Cinchonas is considerably greater than in the stem-bark:—

YELLOW.	PALE.	RED.
Usually in flat uncoated pieces.	Always in narrow cylindrical quills.	Usually in flat, coated pieces; thick and compact.
Outer surface brown; inner, tawny-yellow, fibrous.	Outer surface brown, or grey, and speckled with lichens; inner, cinnamon-brown.	Outer surface reddish-brown, frequently warty; inner, redder; fracture, brick-red.
Powder cinnamon-brown.	Powder pale-brown.	Powder red-brown.
Taste very bitter, slightly astringent.	Taste slightly bitter, very astringent.	Taste bitter and astringent.
Infusion is precipitated by sodic sulphate.	Infusion is not precipitated by sodic sulphate.	Infusion is not precipitated by sodic sulphate.
Contains at least 2% of quinia, exclusive of other alkaloids.	Contains at least 0.5% of alkaloids, i. e. of quinia + cinchonina.	Contains at least 1.5% of alkaloids, i. e. of quinia + cinchonina.

*Test.* —Cinchona bark varies much as to quality, and spurious barks are sometimes substituted for the true; but the only reliable test of the quality of Peruvian bark is the determination of the yield of alkaloids by an analytic process, called *cinchonometry*.

For an explanation of the details of the test, which occupies a good deal of time, see Quiniæ Sulphas.

In the extraction of quinia from yellow bark, ether is used as being the best solvent for that base; while, in the case of pale and red bark, chloroform is substituted for ether, in order to take out the cinchonina also, which is not soluble in ether.

Yellow bark ought to contain an amount of quinia about 1.3 times that of all the alkaloids in red bark, and four times that of all the alkaloids in pale bark.

*Chemical History.*—Pelletier and Caventou in 1820 were the

first to demonstrate satisfactorily the existence of quinia and cinchonia in Peruvian bark, and to establish the fact that the febrifuge properties of bark depend on the presence of these principles. Within later years additional alkaloids have been isolated, and there are now known at least five distinct bases derived from bark, viz., quinia and quinidia, isomeric with each other; cinchonia and cinchonidia, also isomeric; and aricina. To these Hesse adds paricine and quinamine, and he thinks the existence of aricine not proven. The so-called quinicia and cinchonicia are the products of the action of heat on quinia and cinchonia. The term "quinidine" has been applied to several different substances, and commercial "sulphate of quinidine" is often nothing but sulphate of cinchonidine, containing some quinine (Hesse).

All the varieties of bark contain quinia and cinchonia, accompanied, as a rule, by quinidia and cinchonidia, in combination with kinic acid; and, in addition, tannin, starch, colouring matter, and some other unimportant ingredients. Those barks which are richest in quinia also contain most lime. The alkaloids are deposited only in the liber or inner bark, the usual seat for elaborated products. It is not improbable that the alkaloids may be produced by reactions between the ammonia contained in the bark and the cincho-tannic acid.

The yellow bark contains most quinia, the pale bark most cinchonia, and the red bark a considerable proportion of each. (See Table.) With ferric salts, the cincho-tannic acid of pale bark gives a deep green, of yellow bark, a blackish brown, and of red bark, a reddish brown.

In the following table the composition and leading properties of the five cinchona-alkaloids are exhibited:—

CHARACTERS.	QUINIA.	QUINIDIA.	CINCHONIA.	CINCHONIDIA.	ARICINA.
Composition, .	$C_{20}H_{24}N_2O_2$	$C_{20}H_{24}N_2O_2$	$C_{20}H_{24}N_2O$	$C_{20}H_{24}N_2O$	$C_{23}H_{26}N_2O_4$
Polarisation,	Left.	Right.	Right.	Left.	
Solubility in water at 68°,	In 1667 parts.	In 2000 parts.	In 3670 parts.	In 2580 parts.	Almost insoluble
In water at 212°.	In 902 parts.	In 750 parts.	In 2500 parts.	In 1858 parts.	
Solubility in ether, . .	Tolerably soluble.	Tolerably soluble.	Scarcely soluble.	Almost insoluble.	Soluble.
Cl & $NH_3$ test,	Green ppt.	Green ppt.	White ppt.	No change.	
KI test, . .	No ppt.	White ppt.	No ppt.	No ppt.	

*In Pharmacy.*—The different kinds of Cinchona bark yield their virtues partly to water, e. g. Decoct. ; Infus. ; and Ext. Cinch. Liq. ; to spirit, e. g. Tinctura ; and best to diluted acid, e. g. in the extraction of Quiniæ Sulphas. Since the natural alkaloidal salts in the bark are decomposed by water into acid and basic salts, the latter of which are insoluble in water, it is plain that water alone cannot exhaust the bark thoroughly ; and, in fact, the bark-residues from the preparation of the decoction and infusion always yield still some quinia and cinchonia. In consequence of its richness in quinia, yellow bark (also, the bark of Cinchona lancifolia) is employed as the source of sulphate of quinia ; and from this bark also most of the Galenical preparations are prepared. Owing to the presence of alkaloids all preparations of bark give precipitates with tannic acid, tincture of iodine, alkalies, alkaline carbonates, and alkaline earths ; and these facts should be borne in mind in prescribing bark in combination with other drugs.

Permanganate of potassium converts quinia into a modified compound destitute of bitterness, and possibly the same body as that found in the urine of persons who have taken considerable quantities of quinine.

The relative amount of bark in the liquid preparations per fluid ounce, is, in grains :—

		Ratio.
Infus. Cinch. Flavæ,	. . . 22	1·00
Decoct.,	. . . . . 27	1·25
Mist. Ferri Arom.,	. . . 27	1·25
Tinct. Cinch. Comp.,	. . . 44	2·00
Tinct. Cinch. Flavæ,	. . . 88	4·00
Ext. Cinch. Flavæ Liq.,	. 1750	80·00

Or, in other words :—One ounce of the liquid extract represents four pints of the infusion of yellow bark; three pints of the decoction; and one pint of the tincture of yellow bark.

*In Medicine.*—The general action of quinine upon animal life may be thus briefly stated. To the lowest organisms (protozoa), it proves poisonous and lethal even in very minute quantity, and in this respect, is not surpassed by the most powerful vegetable poisons (e. g. strychnia or morphia). But to the higher animals, upon which these latter drugs act toxically in small doses, quinine is not, as a rule, injurious except in very large doses.

Furthermore, quinine hinders alcoholic and other forms of fermentation, and proves to be an active protoplasmic poison, especially to the white corpuscles of the blood.

Upon the remaining constituents of the blood, quinine appears to exert no action. Apart from the salivary glands which it stimulates to increased activity, quinine does not seem to act upon the secreting organs. In health quinine has a three-fold action; firstly it diminishes the frequency and force of the action of the heart; secondly, it lowers the tension in the arterial system; and, thirdly, it lowers the temperature, or prevents its elevation by exercise, &c. (Sée).

The main therapeutical properties of bark and of quinia, are those of a tonic, antiperiodic and febrifuge nature. Its stimulant action is shown especially on the nervous system, and the

effects of an overdose (cinchonism) are fulness and pain in the head, dimness of sight, singing in the ears, with partial deafness, slowing of the pulse, &c., and these effects, if continued, are followed by nervous depression and prostration.

Several cases have occurred in which the administration of *small* doses of quinine was followed by an erythematous rash on the face and body, succeeded by desquamation, as in scarlatina. In most instances the subjects of the eruption were women usually of middle age, and generally of nervous irritable temperament. The workmen in quinine manufactories are liable to a papulo-vesicular eruption on the body and limbs, attended with swelling of the genitals or face.

As a tonic, quinine is extensively employed in many diseases attended with debility and loss of appetite, or with profuse discharges, and in the convalescence from febrile or exhausting affections, and as a stimulant in low, typhoid forms of disease. Care should be taken in prescribing it to ascertain the absence of any local irritation or inflammation of the stomach and bowels. Quinine is used to reduce the temperature and frequency of pulse in some febrile diseases, especially in typhus, yellow fever, acute rheumatism, pyemia, pneumonia, hectic, acute exanthems, and puerperal fever.

The astringent properties of bark are also not to be forgotten, and the red bark is sometimes used as a local application to flabby ulcers, and mucous relaxation. In the astringency of cinchona lies one of the chief differences between its action and that of its alkaloids.

As an antiperiodic it has been in use since the time it was first known in the treatment of intermittent and remittent fevers, and of their sequelæ, ague-cake, dropsy, &c., and few cases of these diseases resist the judicious use of bark. Not only is it specifically curative of intermittent fever, but it also proves itself invaluable as a prophylactic.

It is probably best given, in full doses, during the intermis-



sions. Other diseases of an intermittent type, i. e. regularly recurring, such as periodic neuralgia, and recurring diarrhœa and dysentery are often most effectually treated by the exhibition of bark or quinia, but even a mere enumeration of the special applications of bark would exceed our present limits.

When quinia is given internally, it is eliminated unchanged in great part, by the sweat, tears, milk, saliva, but chiefly by the urine, and its presence in the urine may be ascertained within half an hour after its ingestion. A solution of iodine in iodide of potassium (biniodide of potassium) is the best reagent for detecting it in urine; a brown precipitate is produced.

Drs. Bence Jones and Dupré have constructed a plausible theory of the mode of action of quinine based upon experiment. They discovered some years ago the existence of a peculiar fluorescent substance occurring normally in the animal tissues, which answers to the various tests for quinine, and which is termed, *animal quinoidin*.

They suppose that this principle being deficient or absent in certain diseases, e. g. ague, quinia and its salts may supply its place, and so remedy the disease.

*Administration.*—Sulphate of quinia (commonly called *quinine*) is rapidly supplanting the older preparations of bark, and although the most important properties of bark are certainly concentrated in its alkaloids, yet there is evidence that in some cases at least, the bark in substance, or its Galenical preparations, have succeeded where the alkaloid failed.

For antiperiodic purposes the alkaloids are almost exclusively employed, and the experience of Indian medical men has shown that the sulphates of cinchonia, cinchonidia, and quinidia are efficacious febrifuges and tonics, similar in action to sulphate of quinia, although somewhat weaker.

The chief objection to the use of bark in powder, or of the decoction and infusion, is their liability to disagree with the stomach. The bitter taste is said to be concealed by milk, and

especially by coffee or chocolate. The Ext. Cinch. Liq. is, we have seen, a very concentrated aqueous solution of yellow bark, and may be given in doses of 10 to 20 minims. The dose of the infusion or decoction is  $\text{ʒi.}$ ; of the Tinctures,  $\text{ʒss. to ʒi.}$ ; and of sulphate of quinine, 1 or 2 grs. as a tonic, 5 to 15 grs. as an antiperiodic. Heberden's ink (Mist. Ferri Arom.) is an aromatic tonic preparation of pale cinchona, containing tannate of iron; dose  $\text{ʒi. to ʒij.}$  "Quinine" is frequently prescribed in pill, and sometimes in bolus, but most usually in aqueous solution along with a little free acid, e. g. sulphuric or hydrochloric. Sulphate of quinine has been used with some success hypodermically,  $\frac{1}{2}$  to 1 gr. of the acid sulphate; but it is liable to set up local inflammatory mischief.

Numerous other salts of quinine beside the sulphate have been proposed, such as the hydrochlorate, valerianate, acetate, citrate, &c., and about thirty different quinine compounds have had their respective advocates.

### CINNAMOMI CORTEX.

*Origin.*—The barks of all the species of the genus *Cinnamomum*,\* N. O. Lauracæ, possess analogous properties, and they are fairly entitled to the common designation of cinnamon just as cinchona stands for the barks of all the cinchonas collectively.

Two principal species of cinnamon bark occur in commerce, one known as Ceylon cinnamon, the product of *C. zeylanicum*, and alone recognised as genuine in the Pharmacopœia; the other, Chinese cinnamon, an inferior kind, is the product of *C. aromaticum*, and is often known as Cassia bark. The aromatic quality of the bark is much influenced by the circumstances of soil, climate, and mode of culture.

\* *Kinamon*, Arab.

In order to obtain cinnamon, the bark of the young shoots of plants, six or seven years old, is divided by longitudinal cuts, and split off by a proper instrument. The outer and valueless layers of the bark are removed by scraping, and the thin bark, on being allowed to dry, contracts into small rolls or quills, the finer tubes being introduced within the larger so as to produce a laminated arrangement. These cylinders are afterwards collected into bundles, and bound together by pieces of split bamboo.

*Characters.*—The best Ceylon cinnamon occurs in very thin, light-coloured, multiple quills, smooth, and having a splintery fracture. The Chinese or false cinnamon is in thicker and darker tubes, usually single-rolled, seldom more than double. It is less agreeably aromatic, but nevertheless is much employed by pharmacutists. Tincture of iodine gives a blue colour with decoction of cassia bark, but not with true cinnamon.

The most important constituent of cinnamon is a volatile oil (*Oleum Cinnamomi*), which is heavier than water, and forms about six parts in 1000 of bark. This oil consists chiefly of cinnamic aldehyd,  $C_9H_8O$ . The tannin which exists in the bark gives a greenish precipitate with persalts of iron.

*In Pharmacy.*—Cinnamon yields its sensible qualities and medicinal virtues to water, e. g. *Aqua Cinnam.*, and more readily to spirit, e. g. *Tinct. Cinnam.*

*In Medicine.*—An agreeable and cordial aromatic, seldom prescribed alone, but in much demand as an adjuvant to other less pleasant medicines; and it accordingly enters into a number of officinal preparations. It possesses some astringent virtue, and, when combined with chalk (*Pulv. Cretæ Aromat.*), it is often beneficially employed in diarrhœa, especially with children. In scruple doses it has been recommended in passive hemorrhages from the lungs.

## COCCUS.\*

*Origin.*—Cochineal consists of the impregnated female insect of *Coccus Cacti*, Class Insecta, Order Hemiptera. The male has two wings, but the female is wingless, and the proportion of males to females is about one to 100 or 200. The insect is a native of Mexico and Central America, and is carefully reared on the Nopal cactus (*Opuntia cochinillifera*), upon which the animal lives and breeds. The females increase in size so rapidly after fecundation that ultimately their legs and antennæ are scarcely visible, and they appear almost like inanimate excrescences upon the plant. They are removed from the cactus by a blunt knife or other means, killed by heat, and carefully dried. The males, which are very much smaller than the females, are not collected. Cochineal is largely derived from the island of Teneriffe, into which it was introduced some years ago.

*Characters.*—The oval, reddish-grey, and somewhat angular grains are quite peculiar in their appearance, although scarcely disclosing their insect origin. The dried insect weighs about  $\frac{1}{10}$  gr., and the best cochineal (silver cochineal) has a white, downy bloom in the furrows on the body. Cochineal has been adulterated by dusting it over with various white powders, such as tale, carbonate of lead, sulphate of barium, so as to give it the appearance of the finer variety. Dr. Paris states that in his time it was invariably adulterated with pieces of dough, formed in moulds, and coloured with cochineal, and that this fraud gave employment to a considerable number of women and children in the metropolis.

The powder is of a purplish, carmine colour, tinging the saliva intensely red, and the colour is due to carminic acid,  $C_{14}H_{14}O_8$ . 5 m. of the tincture will colour  $\bar{3}$ i. of water red. Its

\* Κόκκος, an insect.

solution in water or spirit is brightened by acids, and rendered purple by alkalies. The colouring matter is readily thrown down by various reagents, and the precipitates thus obtained are well known as “lake” and “carmine.” Carmine mixed with French chalk or starch constitutes “face-rouge.”

*In Pharmacy.*—Employed in these countries solely as a colouring agent. Its tincture does not become opalescent on dilution, and is so distinguished from a tincture containing red sandal-wood (e. g. Tinct. Lavand. Co.), whose colouring matter is insoluble in water. Tincture of cochineal, if diluted with ordinary water, bleaches completely on a short exposure to air; this is not the case if pure distilled water be employed.

A different species of *Coccus* (*C. lacca*) gives origin to lac resin (shellac—gum lac); another species (*C. ilicis*) is termed “animal kermes;” and Chinese or insect wax is the product of *C. sinensis*.

## COLCHICI\* CORMUS.

## COLCHICI SEMINA.

*Origin.*—Colchicum was known to the ancients as a poison, but it was first brought prominently into notice by Baron Störck of Vienna, in 1763.

All parts of the “meadow-saffron,” *Colchicum autumnale*, N. O. Melanthaceæ (Colchicaceæ), possess medicinal virtues, but the officinal parts are the fresh biennial corm, the dried corm, and the ripe seeds. This species, often called *autumn crocus*, is a native of Britain and Ireland, and of the temperate parts of Europe, and is very peculiar in its manner of growth. In the course of the autumn its elegant lilac-purple flowers emerge from the ground, unaccompanied by leaves (hence its vulgar name of “naked ladies”); a large portion of the long, narrow

\* *Colchis*, a country in Asia.



tube of the corolla being concealed in the ground, and bearing the ovary at its base. In the following spring the leaves come up together with the fruit, which rises upon a stalk above the surface in the form of three-lobed and three-celled capsules, which ripen their seeds about midsummer. As the summer passes a bud, or new corm, begins to form at the base of the old one, and is received into a furrow in its side. Sometimes there is a bud with a corresponding notch on each side. The young corm attains perfection about the middle of next summer, which, accordingly, is the proper time for its collection. The seeds ripen in summer, and should be gathered about August.

*Characters.*—(a) *Of the Corm.* The recent corm resembles a tulip-bulb somewhat in shape, size, and colour, but internally it is solid, white, and fleshy. The fresh juice is bitter and acrid, but its irritating qualities seem to vary considerably according to the conditions of the growth of the plant. The flower of the “meadow-saffron” is very poisonous to cattle, and acts with great severity on dogs (*mort au chien*). Rabbits and frogs seem to be far less susceptible to its influence. As seen in the shops, the drug is always in the form of thin, dried, yellowish-white, kidney-shaped slices, occasionally fiddle-shaped, if the corm possessed two lateral buds and notches.

The most important constituent of colchicum is *colchicin*, or *colchicia*,  $C_{17}H_{19}NO_5$ , at one time thought to be identical with veratria, but proved by Geiger and Hesse to be a distinct body. The seeds yield about 0.208%, and the corms from 0.085% to 0.26% of colchicin. This base is a yellowish-white, scarcely crystallisable substance, slowly soluble in water, easily so in spirit, and insoluble in ether.

The corm also includes a large quantity of starchy matter, and the decoction yields a deep-blue precipitate with tincture of iodine. The intensity of the bitterness is the most convenient test of the quality of the corm or of the seeds.

(b). *Of the Seeds.* The seeds are easily recognised by their



globular shape, extreme hardness, and bitter taste. They resemble black mustard seed in colour, and white mustard seed in size. Compared with the corm they possess the advantage of not being injured by drying, and hence the tincture prepared from them is more certain and uniform in its effects than the wine prepared from the corm.

*In Pharmacy.*—Wine (Vinum Colch.), proof spirit (Tinct. Colch.), or acetic acid (Ext. Colch. Acet.) extract all the medicinal virtues of the corm. The two extracts are prepared from the *fresh* corm, the wine from the *dried* corm, and the tincture from the seeds.

*In Medicine.*—In large doses colchicum is an irritant poison, and occasions severe nausea, vomiting, purging, with nervous and vascular prostration. It produces bilious stools, and is a powerful general sedative. Tannic acid is recommended as an antidote. It is an ancient remedy, and, at present, finds its chief employment in the treatment of gout and rheumatism, and, in the former affection especially, it often affords prompt and effectual relief to the painful symptoms. Its power of arresting a paroxysm of gout was first established by Sir E. Home, but it is rather palliative than curative. Sir C. Scudamore's "white mixture" for gout, was, Magn. Sulph. ʒi. to ʒij., Acet. Colch. (Lond.) ʒi., Magnes. Carb. gr. x. to xv., Aquæ ʒiiss. Fiat haustus.

It is generally considered to possess diuretic powers, and is said to increase the excretion of urea and uric acid, but the experiments of Dr. Garrod are in direct opposition to this. The medium dose of either of the extracts is one gr., and of the wine or tincture, ten to fifteen m., and it is generally more prudent to commence with small doses, since it appears to affect individuals with very different degrees of energy, and in all cases its effects should be carefully watched. It is best given soon after a meal, combined with

some aromatic water, and, if necessary, a little morphia may be added.

Dr. Paris was of opinion that acids rendered colchicum wine drastic, while alkalis rendered its operation more mild, although not less efficacious, and he recommends magnesia as a judicious adjuvant.

## COLLODIUM.\*

### COLLODIUM FLEXILE.

*Preparation.*—Ordinary collodion is a solution of gun-cotton (pyroxylin) in a mixture of three parts ether, and one part rectified spirit. The addition of a little Canada balsam, and a few drops of castor oil to this, constitutes flexible collodion. Glycerin has been recommended instead of castor oil.

Collodion was introduced in 1847 by Mr. Maynard, a medical student of Boston, and the first notice of it was published in 1848. The chemistry of gun-cotton is explained under Pyroxylin.

*Characters.*—Recent collodion is a transparent ethereal liquid, of a syrupy consistence, and leaving upon evaporation a thin transparent film, remarkable for its adhesiveness and contractility, and not removable by washing with soap and water. When insecurely kept the liquid thickens, becomes less fit for use, and sometimes contains acicular crystals of oxalic acid. Inferior collodion leaves a powdery white film on evaporation, devoid of tenacity.

*In Pharmacy.*—Collodion is sometimes made the vehicle of other medicines for external application, e. g. iodine, and ferric chloride. The addition of cantharides to it constitutes the elegant and convenient epispastic known as “vesicating

\* Κόλλα, glue.

collodion.” Pills are sometimes coated with collodion. Mixed with iodide of ammonium, it forms “photographic collodion.”

*In Medicine.*—The film left by ordinary collodion is liable to crack, and by its contractile power, puckering up the skin, it is unsuitable for some purposes, and hence the introduction of a flexible or elastic collodion. Where a contractile effect is desired, as in small nævi, varicocèles, entropion, or piles, collodion is very serviceable, and it offers an admirable means of applying an insoluble and air-tight protecting film over small wounds, ulcers, and incipient bed-sores. Sir D. Corrigan advises the local application of collodion in incontinence of urine in boys. The prepuce is to be slightly curved up, and over the little cup thus formed collodion is to be applied. The contractile cap of gun-cotton prevents the escape of the urine. When necessary the film is easily removed by the finger-nail and can afterwards be renewed as required.

In the flexible form it is the best application to brush over the patches of herpes zoster, and is very useful in cases of chapped nipples, and fissured anus, and as a protective to the face in small-pox. The preparation sold as “styptic colloid,” which is a saturated solution of tannin in collodion, is useful in certain cases; and a convenient and effectual styptic collodion, which I find to answer well, is afforded by Pavesi’s formula, viz., Collodion, 100 parts: Carbolic acid, 10: Pure tannin, 5: Benzoic acid, 3. Mix.

### COLOCYNTHIDIS PULPA.

*Origin.*—The bitter cucumber, *Citrullus Colocynthis*,\* N. O. Cucurbitaceæ, is an annual creeping plant, and bears considerable resemblance to the common water-melon. The fruit is a globular berry (pepo) about the size of an orange, and contains

\* Κολόκυνθα, a gourd.

within the yellow, hard, smooth rind, a white spongy pulp, and numerous oval brownish seeds. The plant is a native of the south of Europe, and the drug is imported chiefly from the Levant. Unpeeled colocynth is brought from Mogador, and is sometimes exhibited in druggists' show-bottles, but is now rarely seen.

*Characters.*—The dried pulp is exceedingly light and spongy, and the seeds which constitute  $\frac{5}{4}$  of the weight of the pulp are separated and rejected because they possess little activity, although nauseously bitter.

The active, bitter, and purgative principle of the pulp is 2% of a glucoside termed *colocynthin*,  $C_{36}H_{84}O_{23}$ , soluble in water and alcohol but not in ether.

*In Pharmacy.*—Occurs in combination with aloes and scammony in the compound pill and extract. The Pil. Coloc. Co. contains relatively about twice as much scammony as the Extractum Coloc. Co., but it seems quite superfluous to include two so similar preparations in the Pharmacopœia. In England the Pil. Coloc. Co. is vulgarly called “Pil-a-coshy.” Colocynth is stated to form the basis of Morison's pills.

*In Medicine.*—Colocynth is an energetic hydragogue cathartic, capable of causing death in an overdose, and seldom prescribed alone. It appears to act feebly upon horses, sheep, and swine. Thunberg states that the fruit is rendered so perfectly mild at the Cape of Good Hope, by being pickled, that it is used as food both by the natives and colonists; and in the north of Africa the seeds are reported to be extensively used as a nutritious article of diet. By combination with other cathartics it loses much of its violence, but retains its purgative qualities, and in the form of the compound extract and pill, it is a favourite and useful medicine.

The addition of  $\frac{1}{3}$  of Extr. Hyoscyami (Pil. Coloc. et Hyoscyami), deprives it of its tendency to gripe or irritate the rectum. Colocynth resembles gamboge in its effects, although less

irritating, and, like aloes, it acts manifestly upon the large intestine. A combination of Pil. Coloc. Co., gr. 4, Resin of Podophyllum, gr.  $\frac{1}{4}$ , and Croton oil, m.  $\frac{1}{6}$ , is a most effectual and safe cathartic in obstinate cases of constipation, or in passive dropsies.

### CONFECTIONES.\*

A confection is a soft medicinal preparation with which is incorporated a considerable quantity of some form of sugar. Under this term are now included the sub-divisions formerly known as *conserves* and *electuaries*; the word “conserve” indicating the preservative effect of the sugar, but there is no essential difference between them. Confections were formerly much more in vogue when it was customary to prescribe complicated farragos of drugs, and even in the last French Codex, one ridiculous formula is introduced which contains sixty distinct ingredients.

Confections should be kept in closely covered jars in order to preserve their proper degree of consistence, which should not be so soft, on the one hand, as to allow the ingredients to separate, nor so firm, on the other, as to prevent them from being swallowed without mastication.

Confections are used either as a direct form for administering medicines (Conf. Tereb.) or, as an agreeable and convenient vehicle for the dispensing of active drugs (Conf. Ros. Can. and C. Ros. Gallicæ.) Of the eight confections the last four are more or less cathartic in their action.

\* *Conficio*, to make up.

## CONFECTIO OPII.

Contains one gr. of opium in forty.

The combination of spices with the opium (Pulv. Opii Co.) renders it more stimulant, and acceptable to the stomach in some cases, and this preparation may be ordered in any disease requiring a stimulant narcotic. It is a simplified form of the ancient cumbrous preparations known under the names of "Theriaca," "Mithridate," and "Philonium."

## CONFECTIO PIPERIS.

Contains one gr. of pepper in ten.

This is a substitute for a well-known nostrum, Ward's\* paste for piles, which has acquired some reputation, although it is not easy to see upon what grounds it can be beneficial. Its stimulating properties render it unsuitable in inflammatory cases.

## CONFECTIO ROSÆ CANINÆ.

A slightly acid conserve, apt to candy when kept, and used merely as a vehicle for making up pills. It is more suitable for dispensing quinine than the next confection, on account of the absence of tannic acid. The "seeds" (achenes) are directed to be removed because the hairs surrounding them act as mechanical irritants, and when swallowed are apt to cause gastric uneasiness, vomiting, and rectal pruritus.

## CONFECTIO ROSÆ GALLICÆ.

Slightly astringent, in consequence of containing some tannin. If pills made up with this red confection are dispensed in mag-

\* Ward was originally a footman, and during his attendance on his master, while travelling on the Continent, he obtained from the monks those receipts which afterwards became his nostrums.



nesia, as is sometimes done, the alkaline earth will, in a few hours, turn the red to green, and the pills will become very unsightly. This confection has no tendency to candy.

### CONFECTIO SCAMMONII.

The aromatics in this preparation will agreeably obviate any irritant tendencies of the scammony. If the drug be of good quality ten or fifteen grains of the confection rubbed up with  $\mathfrak{z}\text{i}$ . of some cordial water, will make an active and safe cathartic draught. The confection, owing to the large amount of resin in the scammony, will not mix well with water, unless first triturated with a little proof spirit, or some suitable tincture. The proportion of scammony is one in three.

### CONFECTIO SENNÆ.

A mild and elegant aperient, popularly known as “lenitive electuary.” Its composition, however, is needlessly complex, and it is quite possible to make an excellent and efficient confection with fewer materials. The nauseous taste of the senna is concealed by the sweet fruits, and its tendency to gripe is corrected by the aromatics. It is well adapted for habitual constipation, especially as met with in pregnant females, and for persons affected with piles. Other aperients, e.g. acid tartrate of potash, may be appropriately combined with it.

### CONFECTIO SULPHURIS.

This, the common “sulphur electuary,” is a favourite form of giving sulphur internally in the treatment of certain skin diseases, and of hemorrhoids. In hospitals and dispensaries treacle is usually substituted for the syrup of orange peel.

## CONFECTIO TEREBINTHINÆ.

This is the most advantageous form of administering turpentine internally, because, not only is it miscible with water, but also the odour and taste of the turpentine are particularly well concealed by the liquorice root. When properly made up the oil of turpentine adheres so firmly to the granules of the liquorice powder, and to the viscid honey, that the confection can be rubbed up with aqueous vehicles, without risk of the turpentine separating. Peppermint water is the most appropriate vehicle in which to prescribe it. If mucilage of gum arabic be added, the mixture becomes curdy after a few minutes. 5i. contains fifteen m. of oil of turpentine.

## CONII FOLIA.

## CONII FRUCTUS.

*Origin and Characters.*—The spotted hemlock, Conium\* maculatum, N. O. Umbelliferae, is a biennial herbaceous plant easily distinguished from all other plants of similar aspect by three characters, viz.:—(1) The *smooth*, shining stem, marked with (2) brownish-purple spots, and (3) the waved ridges on the fruit. The only other British Umbellate with a spotted stem is Myrrhis temulenta, but its stem is hairy. The *leaves*, like those of most Umbellates, are finely divided (decompound), bi- or tri-pinnate, and of a deep green colour on the upper surface. The flowers are small, white, and arranged in compound terminal umbels. The *fruit*, often improperly termed seed, is about one-tenth of an inch in length, dull grey, and, like that of all Umbellates, splits readily when ripe into two five-ribbed half-fruits (mericarps).

Hemlock is indigenous to Great Britain and Ireland, and is commonly found about banks, hedges, waste places, and among

\* Κώνιον, Greek.

ruins, but it is apparently introduced in many of its localities. It flowers in June or July, and the whole plant, especially at this period, exhales a fetid odour particularly when bruised, which is likened to the smell of mice, and is very perceptible even in the dried plant. Climate and season largely influence the activity of the plant, and it is most energetic in hot and dry seasons, and in a dry soil. It is said that peasants eat conium in the Crimea.

The leaves are best gathered when the flowers begin to fade, they should be carefully dried at a moderate heat, and ought to be preserved from the air and light. But the dried leaves even when most carefully prepared, sometimes yield no conia although they possess the hemlock odour and are of a fine green colour. The dried fruit retains its activity much longer than the leaves. By far the most efficient preparations of hemlock are obtained from the *green and nearly ripe* fruits. Conia abounds in the green pericarp, and gradually decreases as this hardens and becomes dry and brown.

*Chemical Composition.*—The three most important constituents of hemlock are (1) a non-poisonous volatile oil, which comes over by distillation, and upon which the odour of the plant depends; (2) an oily alkaloid, conia, which exists in combination, probably with malic acid; (3) a crystalline base, conhydrin  $C_{18}H_{17}NO$ , less poisonous than conia. Conia was discovered by Brandes and Giesecke in 1826, and isolated by Geiger in 1831. Nine pounds of dry hemlock fruit yield about one ounce of conia, i. e. about three grains per ounce. Conia, the chief active principle, is a yellowish, heavy smelling liquid, lighter than water, and like all liquid and volatile alkaloids, it contains no oxygen. The formula of normal conia is  $C_8H_{15}N$ , or,  $\left. \begin{array}{c} C_8H_{14}'' \\ H \end{array} \right\} N$ ; and as it has only one atom of replaceable hydrogen, it is a secondary amine-base. In commercial specimens there is usually also some methyl-conia, i. e. hydrogen

replaced by methyl, i.e.  $C_9H_{17}N$ , or,  $\left. \begin{matrix} C_8H_{14} \\ CH_3 \end{matrix} \right\} N$ . Conia has recently been prepared artificially by Schiff, by the action of ammonia on butyr-aldehyd with the aid of heat. This is the first example of the synthesis of a natural alkaloid. Up to this time conia has not been proved to exist in any other plant than hemlock. Conia is more soluble in cold than hot water, and is the only alkaloid besides aniline which coagulates albumen. It dissolves chloride and oxide of silver, and is a most energetic poison, but it is very readily decomposed, and its activity thus lessened.

Sulphuric acid turns conia purplish-red changing to green; nitric acid, blood red. Warmed gently with concentrated hydrochloric acid it forms a blueish-green crystalline mass.

*Test.*—Conia, according to the Pharmacopœia, may be detected in hemlock or any of its preparations by trituration with caustic potash, when the volatile alkaloid, recognised by its odour, is set free.

But this test is extremely fallacious, for the presence of a mere fraction of conia will give rise to a powerful mousy odour which is usually heightened by the simultaneous separation of a little ammonia.

In examining animal fluids or tissues for conia we should bear in mind that the addition of caustic potash to them will often develop an odour indistinguishable from conia, and quite independent of the presence of that alkaloid.

*In Pharmacy.*—The Extract and Succus are prepared from the *fresh* leaves, the Cataplasm from the *dried* leaves, and the Tincture from the fruit. Of these preparations the only one which can be relied on is the fresh juice or succus. It has been conclusively shown, in particular by J. Harley, that the dried leaves are totally unreliable, that the tincture of the ripe fruit or of the dried leaf may be taken in such doses as to induce inconvenient effects from the alcohol contained in them, and that it

is extremely doubtful whether a stronger extract than one containing 1% of conia can be prepared by any process. The extract of the Pharmacopœia is a scandal to the present state of medical knowledge, and a spirituous extract of the green fruit ought as soon as possible to take its place (Harley).

A good substitute for the cataplasm is a piece of lint saturated with the succus conii, or a bran poultice containing one or two ounces of the succus.

The medicinal effects of conium juice are neither increased nor diminished by the copious addition of alkalies, or of the mineral acids. (Cf. Belladonna.)

*In Medicine.*—The following account of the physiological action and medicinal uses of hemlock is chiefly taken from the admirable work of Dr. J. Harley (*The Old Vegetable Neurotics*), a model of accurate pharmaceutical and therapeutical investigation.

(a). *Physiological Action.*—The operation of conium on man is uniform and invariable, and its chief effects are, first depression of the motor function, and ultimately complete obliteration of all muscular movement derived from the cerebro-spinal motor tract. The earliest indications of its operation are shown by the third nerve, viz., giddiness, ptosis, fixed staring, and dilatation of the pupils. After a full dose the legs suddenly become weak, an intolerable feel of languor comes on, but in an hour or two all these symptoms pass off, and the individual feels as well as ever. Short of a poisonous dose it does not affect the normal spinal cord, and even in its fullest medicinal doses it exerts its power, chiefly if not exclusively, upon the motor centres within the cranium, especially the corpora striata. The more active a person is in habits or constitution, the less susceptible will he be to the influence of conium.

It is devoid of any narcotic or directly hypnotic effects, and exerts no influence upon the circulating organs, upon the secretions or excretions, or directly upon nutrition.

Persons who use tobacco freely, usually require a large dose of conium to produce its physiological effects, and conversely those who are readily influenced by comparatively small doses of hemlock cannot tolerate tobacco.

The combination of the alkaloid, conia, with the organic radicals, methyl and ethyl, diminishes its poisonous activity and abolishes any tendency to convulsant effects or other symptoms of abnormal activity of the reflex function (Crum Brown and Fraser). Conia, according to Harley, cannot be detected in the breath, sweat, fæces, or urine, and hence appears to be decomposed within the system ; but Orfila, Zaleski, and Dragendorff, state that they have detected it in the spleen, kidneys, lungs, liver, blood, and urine of animals poisoned by the alkaloid. Speaking generally, as the result of numerous and varied experiments, conia appears to act toxically upon all classes of animals, vertebrate and invertebrate, although the contrary has been asserted of some of the higher animals.

(b). *Medicinal Use*.—The main indication for the use of hemlock in disease is the existence of any irritation of the motor centres, direct or reflex. It is well adapted to the convulsive diseases of children, and is essentially a children's medicine. Hence it is very useful in the states of irritation occurring at or near the time of dentition, with a strong tendency to or often running into actual convulsions, and in those cases of epilepsy due to morbid excitement of the motor centres. In chorea, although the expectations at first held out have scarcely been fully realised, it certainly is a palliative in large doses, and is borne for a long time with safety.

In certain spasmodic nervous affections, e. g. laryngismus stridulus, and whooping-cough, it exercises a most soothing influence, but in organic cerebral disease it is useless. In some strumous diseases, e. g., scrofulous ophthalmia, and glandular swelling, the free exhibition of hemlock internally is highly spoken of, and deserves a full trial. The poultice may be applied to cancerous and painful ulcerations.



*Administration.*—The best, and indeed the only trustworthy officinal preparation is the Succus which should be given freely,  $\mathfrak{z}\text{i.}$ , to  $\mathfrak{z}\text{iv.}$  at a time, until some of its minor physiological effects are produced, e. g. giddiness and languor. Dr. Fleming recommends a conserve made of equal weights of the fresh green fruit and white sugar, to be recently prepared; dose five grs. or more in pill three times a day.

The combination of conium with opium, belladonna, or hyoscyamus mutually intensifies their actions. The liquid alkaloid conia has also been occasionally employed both internally and externally; dose  $\frac{1}{4}$  to  $\frac{1}{8}$  m.

The Vapor Coniæ (B. P.) is a worthless preparation on account of the fractional quantity of conia which can be thus obtained. It is far better to employ either the Succus Conii with a little caustic potash, or a solution of one gr. conia in  $\mathfrak{z}\text{iv.}$  of spirit and water; 20 m. =  $1\frac{1}{2}$  gr. conia.

### COPAIBA.\*

*Origin.*—Several oleo-resins, i. e. mixtures of resin and volatile oil are officinal, e. g. Frankincense (Thus), and Canada balsam (a true turpentine); but the most important is the so-called Balsam of Copaiba derived from *Copaifera multijuga*, N. O. Leguminosæ, and also from a number of other species of the same genus, all natives of South America and West India.

Copaiba was first made known by Marcgrave and Piso in 1648. It is obtained by making deep incisions into the stems of the trees, and as it first exudes is clear, colourless, and thin, but soon thickens and acquires a yellowish tinge.

*Characters and Tests.*—Copaiba is most closely allied to the turpentine, and as it contains no benzoic or cinnamic acid can-

\* As if *copaliba*, from *copal*, the American name for an odoriferous gum, and *iba* or *iva*, a tree.

not properly be ranked with the true balsams, such as Balsam of Peru.

Light yellow and rather more viscid than sweet oil when recent, it becomes on ageing, especially if at all exposed to the air, darker and more tenacious. But the copaiba of commerce presents a considerable variety of appearance as might naturally be expected from its various botanical sources. The odour is quite characteristic, and can be readily detected in the urine and breath. Sp. gr. usually about 0.950. It is insoluble in water, but entirely soluble in absolute alcohol, ether, fixed and volatile oils, and in strong alkaline solutions, at least if much acid resin be present. Its essential ingredients are volatile oil,  $C_{15}H_{24}$  or  $C_{20}H_{32}$ , 30–80%; a crystallisable resin, copaivic acid,  $C_{20}H_{30}O_2$ ; and an amorphous indifferent resin. By distillation the volatile oil comes over (*Oleum Copaibæ*) and a greenish-brown resin nearly destitute of smell and taste remains behind. The proportion of resin increases by age. If triturated with  $\frac{1}{16}$  of its weight of magnesia or of slaked lime and set aside, it gradually assumes a solid consistence, owing to the formation of copaivate of magnesium or calcium.

Copaiba is liable to several *adulterations*, viz.:—fixed oils, e. g. castor oil, and volatile oils, e. g. oil of turpentine. The former is detected by the diffused greasy stain left by a drop or two gently warmed upon paper, and the latter by its odour when heat is applied.

Of late years a substitute for copaiba has been imported from the East Indies, termed *wood oil*, or *gurjun balsam*, derived from different species of *Dipterocarpus*, N. O. *Dipterocarpeæ*. It is a clear olive-brown liquid, green by reflected light, and bears in many respects a close resemblance to copaiba, from which it is easily distinguished by two tests:—(1) When heated to  $270^{\circ}$  it becomes turbid and coagulates so that the vessel may be inverted with safety (Lowe); (2) When mixed with an equal volume of benzol it forms a muddy mixture. Copaiba forms a transparent

solution (De Vrij). Copaiba, moreover, is not fluorescent. The substitution is not of much moment since the "wood oil" seems to have similar therapeutic powers to the copaiba. Wood oil consists of gurjunic acid,  $C_{22}H_{34}O_4$ , and a volatile oil,  $C_{20}H_{32}$ .

*In Medicine.*—Its general action is that of a stimulant, particularly to mucous membranes, and in especial to that of the urinary passages. It not very unfrequently causes a bright red, measly, papular eruption on the skin, somewhat resembling urticaria, and occasionally produces purging, strangury, and hematuria. The urine of patients under its influence gives a white precipitate (copaivic acid) with nitric acid, which might be mistaken for albumen, but is easily known by its levity, and by its solubility in ether, alcohol, or oils. Copaiba is chiefly used in the treatment of leucorrhœa, and of gonorrhœa, after the more acute symptoms have subsided; but it is sometimes of advantage in other catarrhal affections, such as chronic bronchitis. As a stimulating diuretic it sometimes acts with great benefit in dropsy, and in obstinate cases of psoriasis it now and then seems to effect what arsenic fails to do.

*Administration.*—The average dose is 3 ss., and it is usually prescribed (*a*) in emulsion, with yolk of egg and sugar, mucilage, or liquor potassæ; (*b*) in gelatin or membranous capsules, ten to fifteen m. in each; (*c*) floating on an aromatic water, or with Sp. Æther Nitr.; (*d*) made into a paste with carbonate of magnesium, flavoured with oil of peppermint, and in this form it agrees well with the stomach.

The volatile oil may be given in doses of ten to fifteen m., and an enema of copaiba is sometimes resorted to.

## CORIANDRI FRUCTUS.

*Origin.*—*Coriandrum*\* *sativum*, N. O. Umbelliferae, is an annual plant, a native of Italy, but which grows freely in

\* Κόρις, a bug, from the odour of the fresh fruit.

Britain. It is remarkable that all parts of the fresh plant are extremely fetid when bruised, while the fruit acquires an agreeable aromatic odour by keeping.

*Characters.*—It is the only globular umbellate fruit, often improperly called a seed, and is not, like its allies, usually separated into the two half-fruits (mericarps) of which it consists. The only important constituent is an agreeable volatile oil,  $C_{10}H_{16}$ ,  $H_2O$ , obtained by distillation in small quantity. One pound of fruit yields about forty grs. of oil.

*In Pharmacy and Medicine.*—Employed only in combination with other medicines, either to cover their taste (rhubarb), or to render them acceptable to the stomach, and to correct their griping qualities (senna).

### CREASOTUM.\*

*Origin.*—True creasote, discovered by Reichenbach in 1830, is an oily liquid, obtained by the destructive distillation of wood; but it is frequently confounded with, and replaced by a solution of carbolic acid, which is obtained from coal-tar oil. (See Acidum Carbolicum). In fact, the creasote of commerce is often nothing but an impure carbolic acid, from which, however, it should be carefully distinguished. (See p. 262.) The preparation of creasote from wood-tar oil is tedious; it involves repeated distillations, and a number of processes for the removal of the hydrocarbon impurities which accompany it (cupion, paraffin, &c.)

*Characters and Tests.*—Pure creasote is an oleaginous liquid, possessing a caustic burning taste, and a strong penetrating odour, like that of smoked meat, yet quite different from that of carbolic acid. The taste is so powerful that it can readily be detected in a solution of one part of creasote in ten thousand of water. The smell of creasote is best removed from the fingers

\* *Κρέας*, flesh, and *σώζω*, to preserve; from its antiseptic qualities.

by washing them with chlorinated water. It burns with a sooty flame. When applied to the skin it corrugates and whitens the cuticle, and it communicates a temporary greasy stain to paper.

It has neither acid nor alkaline reaction, is slightly soluble in (one in eighty), and scarcely miscible at all with water, but is readily soluble in strong acetic acid (*Mistura Creasoti*). It boils at  $400^{\circ}$ , and remains fluid at  $17^{\circ}$  below zero. As to its real nature much doubt long prevailed, but creasote has lately been shown to be, not a definite single compound, but a mixture chiefly of two homologous bodies, viz., Guaiacol,  $C_7H_8O_2$ , and Creasol  $C_8H_{10}O_2$ . When guaiacum resin is submitted to destructive distillation, a fluid is obtained, which, in many respects, bears a great resemblance to creasote, and, in point of fact, does contain guaiacol and creasol (homo-guaiacol). Various impurities and adulterations are apt to occur in creasote. (a) Oily hydrocarbons, detected by their insolubility in glacial acetic acid; (b) fixed oils, which cause a permanent greasy stain on paper; (c) carbofic acid, detected by its giving a violet-blue colour with ferric chloride in *aqueous* solution. In the Pharmacopœia the colour test with a slip of deal and hydrochloric acid is erroneously given as one of the characters of wood creasote: it is quite fallacious.

Moreover, true creasote is soluble in *anhydrous* glycerin, but not in ordinary glycerin which contains some water, whereas carbofic acid readily mixes with glycerin in all proportions. A clear solution of creasote with an equal weight of anhydrous glycerin becomes turbid on the addition of a little water, while a similar solution of carbofic acid may be diluted with water without separation of carbofic acid. The distinctive characters of carbofic acid and creasote are exhibited in the subjoined table.

## CARBOLIC ACID.

Derived from coal-tar.

In colourless acicular crystals.

Sp. gr. 1.065.

Soluble in twenty parts of water.

Boiling point 370°.

No effect on polarised light.

Formula =  $C_6H_6O$ .

With nitric acid yields pure picric acid, which gives a yellow crystalline precipitate with potash.

Heated with ammonia yields aniline, which, with chloride of lime, strikes a blue colour.

With collodion forms a clear jelly.

Blue colour with *aqueous* solutions of ferric salts.

## CREASOTE.

Derived from wood-tar.

Not solidified by intense cold.

Sp. gr. 1.071.

Very sparingly soluble in water.

Boiling point about 400°.

Dextro-gyrate.

Formula =  $C_7H_8O_2 + C_8H_{10}O_2$ .

With nitric acid yields oxalic acid, and a resinous mass.

Does not yield aniline with ammonia: becomes turbid.

Does not gelatinise with collodion.

Brown colour gradually with *aqueous* solutions of ferric salts.

*In Pharmacy.*—If prescribed in pill with oxide of silver, the mass will become warm and may even take fire unless the oxide be first diluted with liquorice or other harmless powder. A dispenser has been astonished by seeing the lid of a box which contained these explosive pills suddenly blown off, and the pills sent rolling over the counter.

*In Medicine.*—Cases of indisputable creasote poisoning in men are very rare, and the local and general effects of creasote are less energetic than those of carbolic acid. Both poisons produce serious constitutional effects upon the nervous system, which are manifested, in the case of creasote, by uneasiness, dyspnœa, prostration, and paralysis, without any signs of the acute spasms which result from carbolic acid poisoning. The blood is found liquid after death from carbolic acid, and no clots are observed such as are commonly seen in death from creasote in the lower animals. Therapeutically, creasote is chiefly used as a sedative, astringent, and antiseptic. Internally, in reference to the first two objects, it is frequently efficacious in



arresting nausea and vomiting, especially when not dependent on structural disease of the stomach, and in obstinate diarrhœa with fetid evacuations. Ten or twelve m. may be inhaled (Vapor Creasoti) with advantage in cases of fetid expectoration or gangrene of the lung. Creasote is usually given in pill, one m. in each, or as the Mist. Creasoti. It may be made into an emulsion with water by the aid of a little mucilage. Since creasote is very soluble in volatile oils and in spirit, it may be prescribed in a draught along with various tinctures, e. g. Tinct. Aurantii Recentis, Tinct. Limonis, and Tinct. Lavand. Co. The subjoined formula yields a translucent, greenish-yellow draught, viz., Creasote, m. i. to ij., Tinct. Calumbæ ʒ ss. to ʒ i. Aquæ ʒi.

Externally, creasote has been recommended in a number of affections, but, of late years, it has been supplanted, not always justly, by its rival, carbolic acid. It may suitably be applied as a lotion (two to five m. in ʒi.), to indolent and gangrenous ulcers, or burns; and, in the form of ointment, to chronic scaly eruptions, erysipelas, and chilblains. In tooth-ache arising from carious exposure of the nerve, prompt and radical relief is often obtained by carefully introducing one to two drops on a little cotton-wool, first cleaning out the cavity thoroughly. Death has occurred through inflammation of the glottis, from the pellet falling out of the tooth and dropping into the larynx. Creasote is also an efficient styptic, and its antiseptic powers stand very high. Immersion in creasote water will preserve many organic substances from decay for a long time.

## CRETA. (See p. 171).

## CRETA PRÆPARATA. (See p. 172).

## CROCUS.

*Origin.*—Saffron is the only example of the stigma of the flower being employed in medicine. The common cultivated saffron, *Crocus sativus*, N. O. Iridaceæ, is a native of Greece and Asia Minor, but is cultivated in other temperate countries, and is imported from the south of Europe. Other species of *Crocus* also contribute to the supply of saffron. The flower, which is of a beautiful lilac-purple colour, appears in the autumn a little before the leaves, and from its centre hangs out the thread-like style which terminates in three convoluted stigmas about one inch long, of a rich orange colour, rolled in at the edges, notched and broadest at the summit. One acre yields about five pounds of dry saffron, or about one pound from 60,000 flowers.

*Characters and Tests.*—The finest saffron is dried loosely and is termed “hay-saffron;” an inferior kind dried under pressure is called “cake saffron.” The agreeable odour and flavour of saffron, due to 9% of a volatile oil, are familiar to every one, and it quickly imparts its orange colour to the saliva when chewed. 3i. of the tincture will colour several ounces of water. Exposure to light bleaches the colour.

Saffron is turned green by nitric acid, and blue by oil of vitriol; alkalis render it lighter yellow. Its colouring matter is termed *polychroite* or *crocin*.

On account of its high price, saffron is much open to adulteration, viz.: water; oil, detected by communicating a greasy stain to white blotting paper; flowers of other plants, e.g. safflower (*Carthamus tinctorius*); marigold (*Calendula officinalis*); arnica; and the stamens of crocus, any of which can only be detected by careful inspection after diffusing the saffron through warm

water; fibres of dried meat, detected by the offensive smell when burnt; mineral matter, e. g. sand, which would be left behind upon incineration.

*In Pharmacy.*—Chiefly used to impart colour and flavour to other preparations, e. g. Dec. Aloes Co., Tinct. Opii Ammon., &c. It is also a constituent of the ancient Rufus' pill (Pil Aloes et Myrrhæ).

*In Medicine.*—Formerly much esteemed as an anti-spasmodic and emmenagogue, but is not now believed to possess any real activity. It is frequently ignorantly taken by patients labouring under the exanthemata with the intention of favouring the development of the eruption.

### CUBEBA\*.

*Origin.*—Cubebs, or Java pepper, is the immature fruit of *Cubeba officinalis*, N. O. Piperaceæ. Several other *unripe* fruits are officinal, e. g. bael, pepper, and pimento.

*Characters.*—The short stalk which is continuous with the network of veins on the surface of the berry readily distinguishes cubebs from its ally, black pepper.

The pericarp is hard, and contains within it a single loose seed, covered with a blackish coat, but internally white and oleaginous. The most important constituents are 3 to 7% of a volatile oil,  $C_{15}H_{24}$ ; a resinous acid, cubebic,  $C_{13}H_{14}O_7$ ; and cubebin,  $C_{33}H_{34}O_{10}$ , a white crystalline solid, probably identical with piperin.

*In Pharmacy.*—The volatile oil (Ol. Cubebæ) is officinal, and is isomeric with Ol. Copaibæ. The Tinct. Cubebæ gives a *white* precipitate of resin when diluted with water.

*In Medicine.*—A stimulant to the mucous membranes, especially of the urinary passages, and chiefly used as a remedy in

\* It makes short the penultima because Actuarius and other modern Greeks call it *κούπεπερ*, *κόμπεπερ* *κόμβεβαρ* and *κόμβεβα*. *Apothecary's Prosody*, 1685.)

gonorrhœa, but its nauseating qualities and the large dose required limit its employment.

Like copaiba it sometimes causes transient constitutional disturbance and an urticarious eruption.

Cubebs imparts its odour to the urine and deepens its colour. The dose of the volatile oil is about 10 m.

## CUPRUM\*.

$$\text{Cu} = 63\cdot5.$$

*Origin.*—Copper and its compounds are pretty widely diffused in nature, but the principal copper mines of Europe are those of the Pyrenees in France, Cornwall in England, and Fahlun in Sweden. The commonest ore is *copper pyrites*, a double sulphide of copper and iron,  $\text{Cu}_2\text{S}$ ,  $\text{Fe}_2\text{S}_3$ . *Malachite*, an oxycarbonate, is derived from Australia and Russia.

*Characters.*—Copper is the only red metal, and a delicate test for it in solution consists in immersing a bright piece of a white metal, e. g. iron, in the liquid; the metallic copper is speedily deposited upon the iron.

Next to silver it is the best conductor of electricity, and accordingly is extensively employed in the construction of electrical apparatus, telegraph-cables, &c.

*Action of Acids.*—Copper is readily dissolved by nitric acid, hot or cold; by sulphuric acid, only with the aid of heat; and by hydrochloric acid, if air be present.

Many other liquids also act upon copper and bring it into solution, and, therefore, vessels of copper should not be used in pharmaceutical operations, since a very small quantity of the metal would prove deleterious.

Copper is a dyad normally, and acts as such in the (cupric)

\* From the island of Cyprus where it was first wrought by the Greeks.

sulphate; but, like mercury, it also frequently acts as a monad, forming what are called cuprous salts.

In solution copper is easily recognised by the three following tests; (a) The *red* test, deposition of metallic copper upon iron; (b) the *blue* test, excess of ammonia forms a rich deep blue solution; (c) the *brown* test, ferrocyanide of potassium ( $K_4FeCy_6$ ) gives a bulky brown precipitate ( $Cu_2FeCy_6$ ).

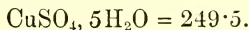
Since mercury and copper belong to the same chemical group, we may usefully compare the corresponding oxides as to colour, a point of practical importance:—

COPPER.		MERCURY.	
Cu''O	{ hydrated — blue.	Hg''O	{ Moist — yellow (e. g.
	{ anhydrous — black.		{ Lot. Hydr. Flava).
Cu'O	{ hydrated — yellow.	Hg'O	{ Dry — red (e. g. red
	{ anhydrous — red (as in		{ precipitate).
	{ Trommer's test for		{ Always black (e. g.
	{ sugar).		{ Lotio Hydr. Nigra).

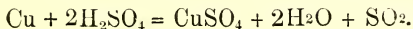
*In Pharmacy.*—Copper is used in the preparation of Cupri Sulphas, and as a deoxidiser in the process for Spir. Æth. Nitrosi. Copper foil. (App. I.) is used in testing Ac. Hydrochlor., and Ferri Phosphas for arsenic by Reinsch's method.

The important alloy *brass*, is a compound of copper with zinc, and *bronze* is an alloy of copper, tin, and zinc.

### CUPRI SULPHAS.



*Preparation.*—Dissolve copper in sulphuric acid by the aid of heat:—



On the large scale it is prepared by roasting copper pyrites. Whenever hot and strong sulphuric acid is required to attack a

metal, sulphurous acid gas is given off; but if the cold dilute acid suffice, hydrogen is set free. (See Ferri Sulphas).

*Characters and Tests.*—Blue stone, or blue vitriol, is the only official blue salt, and like most sulphates, is soluble in water. It has a strong metallic styptic taste, and although chemically neutral, its solution reddens vegetable blues. In dry air it effloresces slightly, at  $212^{\circ}$  loses  $4\text{H}_2\text{O}$ , and at  $400^{\circ}$  it loses all its crystalline water. The anhydrous salt (App. I.) is white, but immediately resumes its blue colour when moistened with water, and hence is used as a test for the presence of water in absolute alcohol (App. I.) With  $\text{BaCl}_2$  it gives a white precipitate of barytic sulphate, and with yellow prussiate (ferrocyanide) of potash a maroon-red precipitate of cupric ferrocyanide. Iron is a common impurity, and is detected by adding chlorine (to peroxidise the iron) and then ammonia in excess, which will redissolve the cupric oxide at first thrown down, but leaves any ferric oxide behind as a reddish brown precipitate. All cupric (per) salts, whether blue or green (verdigris), give a rich blue solution with excess of ammonia. Ammoniacal solutions of cuprous (sub) salts are colourless. Fixed alkalies (potash or soda) precipitate cupric oxide, which is insoluble in excess of the precipitant.

*In Pharmacy.*—Ammonio-sulphate of copper (aqua sapphirina) (App. II.), is employed as a test for the presence of sulphides in Liq. Ammon. Fort., and is also often used as a test for arsenious acid with which it gives an apple-green precipitate of arsenite of copper.

*In Medicine.*—The soluble compounds of copper are extremely poisonous, and in over-doses produce nausea and vomiting, gastric pain, frequent and bloody stools, great depression of the vital powers, and finally death by convulsions. The best antidote is yellow prussiate of potash, but milk or white of egg is more likely to be at hand, and they also form insoluble compounds with copper. Iron filings, if obtainable, would be very serviceable, for they would cause the precipitation of all the copper in



the metallic and inert state. An emetic should, of course, follow the antidote.

The symptoms of slow copper poisoning are emaciation and weakness, a cachectic appearance, colicky pains, dry cough, and retraction of the gums with a persistent purple edge, quite distinct from the blue line caused by lead.

*Externally.*—Blue stone in the solid form is a stimulant escharotic applied to warts, fungous granulations, ill-conditioned ulcers, and granular lids. In weak solution (one or two grs. to ℥i.) it forms a useful wash for chancres, some cases of ophthalmia tarsi, &c. It turns the surface of ulcers green, and forms a coating of insoluble albuminate of copper.

*Internally.*—In small doses,  $\frac{1}{4}$ –2 grs., it is astringent and tonic, and is chiefly recommended in obstinate and chronic diarrhœa, and in epilepsy. Copper is eliminated both by the urine and fæces. In full doses, five to ten grs., it is a prompt emetic, and is especially praised in croup, and in cases of poisoning by opium or other narcotics. But there is risk of some of the salt being absorbed and thus acting injuriously. In general sulphate of zinc is preferable.

### CUSPARIÆ CORTEX.

*Origin.*—True Angustura\* bark is the product of Galipæa Cusparia,† N. O. Rutaceæ.

*Characters and Test.*—The bark is readily characterised by its thin flaky appearance and by the sharp bevelling of the edges. Occasionally there is mixed up with the true bark a poisonous bark known as *false Angustura bark*, and derived from *Strychnos nux-vomica* (see table in Pereira). This false bark contains brucia as well as strychnia, and accordingly a drop of nitric acid on the inner surface causes a deep red spot, moreover

\* So-called from the town of Angustura in South America, whence it is brought.

† *Cusparé*, the native name.

it is thicker, not flaky, rust-coloured on the exterior, and intensely bitter. Fatal accidents from the substitution of the false bark were at one time not uncommon on the continent, and the admixture of the barks is not unknown in this country.

The true bark is not known to contain any alkaloid; a bitter, crystalline, indifferent substance, *cusparin* or *angusturin*, has been obtained from it.

*In Medicine.*—A stimulant tonic. It was at one time considerably used as a febrifuge in the room of Peruvian bark, but is seldom employed now. Dose of the infusion (made with tepid water) ʒi. to ʒij.

### CUSO.\*

*Origin.*—Kousso consists of the flowering tops of *Brayera† anthelmintica*, N. O. Rosaceæ, a tree about twenty feet high, growing on the table-land of Abyssinia, at a height of 6,000 or 7,000 feet. The flowers, which are diœcious, are small and of a greenish colour when recent, but become pink on drying. The reticulated calyx is the more conspicuous part of the flower, and the petals are often wanting in the dried flowers. What is called *red cusso* consists of the female flowers with a large reddish calyx, and is said to be the most active.

*Characters.*—The dried flowers which are imported in compressed clusters or thick rolls have a fragrant odour, and are easily recognised by the five-cleft netted-veined calyx. They contain a considerable proportion of tannic acid, and a bitter, crystalline, indifferent principle, termed *koussin*.

*In Medicine.*—Used solely as a vermicide for tapeworm, but, although its efficacy seems undoubted, the large bulk required for a dose is a serious drawback to its use. It is best taken in

\* An Abyssinian term.

† Dr. Brayer, a French physician, introduced kousso into European practice in 1823.

the morning on an empty stomach, and should be followed in a few hours by a dose of oil. The infusion (not strained) is given freely,  $\mathfrak{z}$ iv. and upwards, but even  $\mathfrak{z}$ i. of powdered cusso is sometimes sufficient to expel the tapeworm. Koussin in forty gr. doses has been recommended by Ditterich.

The Abyssinians, who nearly all labour under tapeworm and ascarides, are in the habit of drinking an infusion of koussou flowers in a liquor made from a species of grass.

### DECOCTIONS.\*

A Decoction is an aqueous solution of vegetable substances obtained by *boiling* the drug in water. It thus differs from an infusion which is an aqueous solution obtained without the aid of ebullition.

The process should be conducted in a covered glass or earthenware vessel, and should not, as a rule, be continued for longer than from five to twenty minutes, as, otherwise, injurious changes are liable to occur. The drug should be coarsely powdered (Dec. Cinch. Flavæ), bruised (Dec. Papav.), or sliced (Dec. Pareiræ), and previous maceration in hot water is occasionally requisite to overcome the cohesion of the vegetable fibre (Dec. Sarsæ). All vegetable substances are not suitable for decoctions. In some, the active principle is volatile at a boiling temperature (e. g. chamomile); in others, it undergoes some change unfavourable to its activity, or again, it is associated with inefficient (starch) or nauseous principles which are extracted by boiling water, and which render the preparation apt to spoil. In all these cases infusion is to be preferred. (See Infusions.) In any case decoctions are prone to spoil in a short time, and hence must be recently prepared. Latterly, concentrated fluid extracts diluted when required with the proper amount of water, are

*Decoquo*, to boil.

sometimes employed as substitutes for decoctions and infusions. Of the fourteen decoctions only two contain more than one active ingredient, viz.:—Dec. Aloes Co., and Dec. Sarsæ Co. The average dose of a decoction is  $\text{ʒi.}$  to  $\text{ʒij.}$

### DECOCTUM ALOES COMPOSITUM.

The carbonate of potash renders the aloes and myrrh more soluble, the liquorice covers the nauseous taste of the aloes as well as aiding in the suspension of any undissolved matter, and the tincture of cardamoms is both an agreeable addition and assists in the preservation of the solution. Long boiling impairs the purgative property of aloes, and therefore only five minutes' boiling is enjoined. It deposits a brown sediment on standing. This preparation contains essentially the same ingredients as the Pil. Aloes et Myrrhæ, and may indeed be looked on as the fluid analogue of Rufus' pill. It contains four grs. of extract of aloes in  $\text{ʒi.}$ , and is a mild, aromatic cathartic, useful in dyspepsia and habitual constipation. It acts well in  $\text{ʒi.}$  doses, repeated, if necessary, at short intervals. In certain cases it may be advantageously combined with tartrate of potash, or with tartarated iron; but, on account of the presence of carbonate of potash, it should not be prescribed along with acids or other bodies capable of decomposing the alkaline carbonate.

### DECOCTUM CETRARIE.

This must be strained while hot, because on cooling it becomes whitish and gelatinous. While warm its colour is clear brown. The cold decoction is rendered violet red by ferric chloride, and blue by tincture of iodine; but this colour disappears in a short time.

Occasionally prescribed as a mild, demulcent tonic in chronic pulmonary catarrhal affections. A pint may be taken during the day.

## DECOCTUM CINCHONÆ FLAVÆ.

Long boiling injures the properties of Cinchona, and the decoction, on cooling, becomes turbid. The addition of a small quantity of sulphuric acid to the water would increase its solvent powers. Tincture of orange-peel improves the flavour of this decoction, and renders it more acceptable to the stomach. The Decoction is stronger than the Infusion of yellow bark in the ratio of 5 : 4, and is much used as a tonic.

## DECOCTUM GRANATI RADICIS.

This, the only preparation of pomegranate, when given as a vermicide, is apt to nauseate, and often purges.

## DECOCTUM HÆMATOXYLI.

A clear, deep red solution. The cinnamon is added towards the end of the process to avoid the dissipation of its volatile oil. An excellent and unirritating aromatic astringent, well adapted to acute diarrhœa.

Logwood readily colours the urine, and its presence may be detected in that secretion within one hour after taking  $\mathfrak{z}$ i. of the decoction by adding a few drops of solution of ammonia, which strikes with the urine a red colour discharged by an excess of the alkali.

## DECOCTUM HORDEI.

Commonly called “barley water.” The preliminary washing in cold water removes any mustiness or other disagreeable flavour. A well known and useful nutritive drink in febrile and inflammatory affections, perfectly bland, and usually grateful to the patient. The addition of a little lemon-juice and sugar renders it more palatable. Mixed with an equal quantity of good new

milk, and a little sugar, it forms an excellent substitute in some cases for the breast milk.

### DECOCTUM PAPAVERIS.

In making this preparation the seeds should not be rejected as they contain a considerable amount of bland fixed oil, which increases the emollient quality of the decoction. Only used externally (poppy-head stupe) as an emollient fomentation in bruises, sprains, &c.

It is turned brownish red by perchloride of iron, and orange red by nitric acid, indicative of the presence of meconic acid and morphia, respectively.

### DECOCTUM PAREIRÆ.

Apt to become turbid after straining. Chiefly used in chronic catarrh of the bladder.

### DECOCTUM QUERCUS.

A clear brown solution, like beer, and does not deposit any sediment on cooling. It reddens litmus paper.

Usually employed externally as an astringent lotion, or as an injection in leucorrhœa, prolapsus ani, &c. Alkaline solutions diminish or destroy its astringency.

### DECOCTUM SARSÆ.

Long boiling impairs the qualities of sarsaparilla, and in this as well as in the next preparation, the drug is first infused for an hour in hot water and then boiled for ten minutes. Some practitioners administer sarsaparilla very freely to the extent even of a pint in the day.

The officinal decoction usually produces little or no blue colour



with iodine, whereas decoction of Honduras sarsaparilla becomes blueish black with iodine from the abundance of starch.

### DECOCTUM SARSÆ COMPOSITUM.

An imitation of the celebrated *Lisbon diet-drink*, and formerly called *decoction of woods* from the number of fibrous and woody substances in it. The sassafras, guaiacum, and mezereon might well be dispensed with altogether, and there is no good reason for retaining two decoctions of sarsaparilla. Highly esteemed by some as an alterative tonic in secondary and tertiary syphilis, scrofula, and chronic rheumatism. The much lauded *Zittmann's decoction* is essentially a solution of sarsaparilla.

### DECOCTUM SCOPARII.

One of the best of the non-stimulating diuretics, and often prescribed in conjunction with other remedies of the same class, such as acetate of potash.

The solution gives a black precipitate with ferric chloride.

### DECOCTUM TARAXACI.

A mild tonic, seldom used except in bilious disorders.

### DECOCTUM ULMI.

A feeble astringent solution. Occasionally prescribed in chronic skin diseases, but its value is probably very small.

### DIGITALINUM.

*Chemistry of Digitalis.*—Notwithstanding the repeated attempts of numerous chemists to unravel the nature of the components of digitalis, its literature, up to very recent times, presented an inextricable maze of contradictory data. The whole

subject, for some reason or other, seems to be beset with extraordinary difficulties, and even still requires further elucidation before our knowledge of it can be regarded as definitely settled. The nomenclature of the assumed active principles which has from time to time been proposed, is nothing but a tantalising puzzle of closely similar names, and at least five or six different processes to obtain so-called digitalin, are set forth by their respective authors.

Following the recent investigations of Nativelle, and using the nomenclature of Wiggers, it may be laid down that foxglove contains three peculiar bodies:—

(1) *Digitalin* (digitalein, Nativelle), the most active ingredient, a crystallisable, bitter substance; (2) *Digitalein* (digitalin, Nativelle), an active, but amorphous bitter substance; (3) [An “*inert crystallised substance*,” tasteless, and sparingly soluble in water.

Of these three bodies, digitalin occurs only in the leaves, and is accompanied by the two other compounds, while the seeds contain only digitalein and the “inert substance.”

Nativelle obtained only  $\frac{1}{10}\%$  of crystallised digitalin from the leaves.

*Characters of Pure Digitalin.*—Fine, white, silky needles, neutral in reaction, very sparingly soluble in water, and insoluble in ether, but readily taken up by chloroform. Formula,  $C_{49}H_{78}O_{30}$  (?). With hydrochloric acid it gives an emerald green, and with concentrated sulphuric acid and bromine vapour (Grandeau's test) a red colour, becoming green on dilution. It is intensely and persistently bitter. *Digitalein* is easily soluble in water.

It is very unfortunate that two such closely similar and confusing terms as digitalein and digitalin should have been selected for different substances.

The process given in the Pharmacopœia for the preparation of digitalin is that of MM. Homolle and Quevenne, modified by M.

Henry. The principal steps of it are: (a) An alcoholic extract is prepared; (b) To the filtered solution of the extract in acidulated water, tannic acid is added which precipitates tannate of digitalin; (c) This precipitate is rubbed up with oxide of lead and the liberated digitalin dissolved out from the tannate of lead by rectified spirit.

*Characters.*—The digitalin of Homolle, (French digitalin), who discovered it in 1841 agrees in many of its characters with those of pure digitalin as given above, but Homolle's digitalin is really a complex mixture, and appears to contain at least three different compounds.

Digitalin prepared by Walz's process (German digitalin), does not differ in any important respect in action from French digitalin.

The practical point, indeed, to remember is that the "digitalin" of commerce is essentially a mixture of two active principles, true digitalin, and digitalein.

It is not yet determined whether pure digitalin belongs to the class of glucosides.

*In Medicine.*—The effects and uses of digitalin are those of *Digitalis* under which they will be described.

The initial dose of digitalin internally should not exceed  $\frac{1}{60}$  gr. In France digitalin is given in the forms of granules ( $\frac{1}{60}$  gr. in each), syrup, and mixture; in Germany, in the form of pilules. It has also been employed subcutaneously, but hitherto has not been often prescribed in Great Britain.

## DIGITALIS\* FOLIA.

*Origin.*—The *Digitalis purpurea*, N. O. Scrophulariaceæ, is a beautiful plant found abundantly in Great Britain and Ireland, especially in woods, and on heaths and banks. It is frequent on

\* *Digitabulum*, a thimble, from the shape of its flowers. It was called by an old writer "Thimblewort;" in German it is "Fingerhut."

siliceous soils, but is very rare on limestone except when there is some admixture of silex. Although such a striking plant it is unnoticed in the writings of the ancient herbalists, and was first named *Digitalis* by Fuchsius in 1535.

During its first year the plant forms a tuft of large, shortly-stalked leaves, and in the following summer, a single, erect, downy, and leafy stem terminating in a long raceme of beautiful purple bell-shaped flowers which usually hang down towards one side. The monopetalous corolla is in shape and size not unlike the end of the finger of a glove, and hence its popular name of foxglove (i. e. folks-glove) which occurs in Saxon writings of the eleventh century. There is a common variety with white flowers. The leaves are the only part employed in medicine; the seeds are too troublesome to collect on account of their minuteness, and are less active.

The wild plant is stated to be more active than the cultivated, and to attain its maximum power in May before the development of the flowers.

*Characters.*—The large wrinkled velvety leaves, with an obtusely serrated edge, are quite characteristic, and can with a little care be distinguished from the leaves of such plants as *Verbascum Thapsus* (Mullein), *Symphytum officinale* (Comfrey), and especially *Inula Conyza*, which are sometimes substituted.

The leaves should be gathered in the second year, dried with great care, and preserved in close tin canisters so as to exclude light and moisture. Foxglove deteriorates by long keeping. The leaves have a bitter nauseous taste, and a faint narcotic odour when dried. When well prepared the powder of the leaves has a fine green colour, and retains the intense bitterness of the fresh leaves.

*In Pharmacy.*—*Digitalis* yields its virtues both to water (*Infusum*), and to spirit (*Tinctura*).

*In Medicine.*—In single very large doses it causes green vomiting, and purging, cold sweats, stupor, feeble irregular

pulse, and death by convulsions. The proper treatment in a case of poisoning is to maintain the patient in a recumbent position, administer a stimulating emetic, followed by the use of ammonia and brandy, and the exhibition of strong tea or coffee would also be advisable both on chemical and physiological grounds.

The most important of the physiological effects of digitalis are those exerted upon the circulation. When given in small doses, it reduces the number of beats of the pulse, but, under its further influence, the pulse becomes irregular, and finally, regular and very rapid. It also contracts the capillaries throughout the body. Digitalis seems to exert a primary slowing action *directly* on the heart, and to *increase* its contractile force, rendering the impulse abrupt and strong. Instead of the "opium of the heart," as it has been styled, it should rather be esteemed in the light of the "quinine of the heart." In poisonous doses it may cause a systolic blowing murmur, probably due to irregular contraction of the muscoli papillares.

As a vascular stimulant it may with advantage be employed in continued fever when the heart is weak and the capillary circulation languid.

Regarding the influence of foxglove on the renal secretion, Dr. Brunton, from a careful collation of observations, is led to conclude: (1) That in anasarca, especially from heart disease, digitalis acts as a diuretic; (2) that it sometimes, but not always, acts as such in health; (3) that when it acts upon the intestinal canal so as to cause vomiting and purging, or when it affects the pulse so much as to cause intermittence, and possibly before this takes place, diuresis is much lessened; but a moderate degree of retardation of pulse may co-exist with diuresis; (4) that in large doses it causes suppression of urine, which may last in the human subject for three days. In other words, digitalis is not a diuretic in the sense of an agent eliminated by the kidneys, and producing increased secretion, but is only so

indirectly in virtue of increasing the arterial tension, and by its action on the heart, in cases of enfeebled circulation. Digitalis, especially when combined with squill, is particularly valuable in anasarca dependent on a weak dilated heart.

In fact, the long-accepted theory of digitalis being a cardiac sedative must now be abandoned, and clinical experience certainly agrees with modern views, that the most pressing indication for the therapeutic use of digitalis is cardiac dilatation, with or without hypertrophy. In valvular disease, e. g. mitral insufficiency or obstruction, no benefit need be expected from digitalis except so far as it acts upon the muscular walls, for its therapeutic effect is much the same as that of compensatory hypertrophy of heart.

Heroic doses of digitalis, e. g.  $\frac{3}{4}$ ss. of the tincture at short intervals have been recommended in delirium tremens, and their beneficial effects are stated to be most surprising. It appears to be useful in those cases which are attended by a compressible, rapid fluttering pulse, i. e. evidences of cardiac distention, along with great nervous prostration. In the weak heart of typhus fever, digitalis is sometimes useful as a spur to its flagging powers.

From its influence in causing capillary contraction, digitalis is recommended in various forms of hemorrhage, epistaxis, hemoptysis, and menorrhagia.

Numerous other proposed therapeutic applications of digitalis must be omitted for want of space.

Advanced fatty degeneration of the heart, and extensive atheroma of the vessels, especially the latter, are the main conditions which suggest caution in the use of digitalis. Digitalis is generally stated to have a cumulative action, i. e. it may produce but little effect when continued for some time, and then suddenly break out, and exert a dangerous influence. However, this doctrine needs confirmation and is not supported by sound arguments.

*Administration.*—The average dose of the powdered leaf is



one gr., of the infusion  $\mathfrak{z}\text{ij.}$  to  $\mathfrak{z}\text{iv.}$ , and of the tincture ten to twenty m. An excellent diuretic combination is afforded by Baly's pill, which contains one gr. each of blue pill, squill, and powdered digitalis. The addition of neutral salts of potassium or sodium to the infusion furnishes a useful diuretic mixture. Dr. Fothergill especially recommends a pill composed of half to one gr. of powdered digitalis with an equal quantity of dried sulphate of iron and a little cayenne, in extract of gentian or aloes and myrrh pill.

Externally, a poultice made with the tincture, or, with the fresh leaves bruised, and applied over the abdomen, has sometimes proved effectual as a diuretic when all other means had failed.

### DULCAMARA.\*

*Origin.*—The *bitter-sweet* or *woody nightshade*, *Solanum Dulcamara*, N. O. Solanaceæ, is a graceful, climbing shrub, with elegant, violet purple clustered flowers, including a cone of lemon-yellow anthers, and bearing bright scarlet berries, which remain in attractive looking bunches after the leaves have fallen.

The plant is common to North America and Europe, extending throughout Ireland, although rather rare and local, and grows in bushy and stony places. The stems only are officinal, and should be gathered in autumn after the fall of the leaf.

*Characters.*—The dried twigs, as commonly met with, are of an ash-grey colour, and wrinkled externally. Their taste has given rise to the popular name, bitter-sweet. An alkaloid, termed *solania*,  $\text{C}_{43}\text{H}_{69}\text{NO}_{16}$ , and a yellowish white substance, *dulcamarin*, are the chief constituents.

*In Medicine.*—A feeble narcotic and sedative, but rarely employed now. It has been chiefly recommended in chronic

\* *Dulcis*, sweet, and *amarus*, bitter.

scaly cutaneous diseases. Christison remarks that the idea of its activity probably arose from its having been confounded with the more energetic belladonna, which, at one time, received the same generic name. Garrod administered half a pound of the ripe fruit as a conserve, without producing any definite effect. Dose of the infusion,  $\bar{\text{z}}\text{i.}$  to  $\bar{\text{z}}\text{ij.}$

### ECBALII FRUCTUS.\*

*Origin and Characters.*—The *wild* or *squirting cucumber*, *Ecbalium officinarum*, N.O. Cucurbitaceæ, is a monœcious, trailing plant, like the common cucumber, but without tendrils. The leaves are large, rough, and irregularly cordate, and the yellow unisexual flowers spring from the axils of the leaves. The fruit resembles a small oval cucumber, about one inch and a half long, green, and covered with soft prickly hairs. When fully ripe it partly separates from the stalk, and projects its slimy juice and seeds with considerable force through an opening in the base, sometimes to the distance of twenty yards. Hence its popular name; and for this reason also the fruit must be collected *before* it is completely ripe. The immediate cause of the bursting of the fruit is the osmose of the *thin* fluid of the outer part of the fruit into the *thick* mucus in the centre of the fruit, which is surrounded by a delicate membrane. Eventually this sac is so distended that it gives way at its weakest part, i. e. where the fruit articulates with its stalk.

The plant is a native of the south of Europe, but is cultivated in Great Britain.

*In Pharmacy.*—Used only as the source of Elaterium.

\* 'Εκβάλλω, to cast out.

## ELATERIUM.\*

*Origin and Preparation.*—Elaterium is the spontaneous sediment from the expressed juice of the squirting cucumber fruit. Since much of the active principle resides in the soft central pulp, forcible expression of the juice is to be avoided. The deposit of elaterium usually takes place in three or four hours, and about half an ounce of fine elaterium is obtained from a bushel (forty pounds) of the fruit.

*Characters and Tests.*—Good elaterium occurs in *thin*, grey, curved cakes, not unlike portions of vulcanised india-rubber. Inferior elaterium is thicker, darker, less easily broken, and sinks in water. It is often prepared from the juice that remains after the finer kinds have been extracted.

Elaterium is sometimes adulterated with chalk, detected by effervescence with an acid, and with starch, detected by iodine. Maltese elaterium is inferior to the English variety. The active ingredient of elaterium is a bitter crystalline principle, termed *elaterin* or *elatin*,  $C_{20}H_{28}O_5$ , which is soluble in boiling spirit, but insoluble in water, and in dilute alkaline solutions, and therefore it is precipitated on the addition of caustic potash to an alcoholic solution of the drug. The potash holds in solution a green resinous matter. The best test for the quality of elaterium is the percentage of elaterin it yields, which should not be less than 20%, but it varies greatly. Walz has described four other compounds of doubtful identity as occurring in elaterium.

*In Pharmacy.*—Forms one part in ten of Pulv. Elater. Co.

*In Medicine.*—Locally, elaterium is an irritant, and is apt to excite ulceration of the fingers in those who prepare it. In doses of a few grains elaterium is a most violent acrid poison,

\* 'Ελαύνω, I drive; or, ἐλατήρ, a driver; either from the vigour of its operation upon the bowels, or from the projectile power of the fruit.

and causes gastro-enteritis, with vomiting, griping pain, and profuse diarrhœa. Christison has known  $\frac{1}{10}$  gr. to occasion severe vomiting and purging, and  $\frac{1}{6}$  gr. has proved fatal to a woman aged seventy.\* The stools produced by elaterium resemble water, in which meat has been partially boiled.

In medicinal doses, elaterium is a drastic, hydragogue cathartic, recommended from the earliest ages, and frequently and deservedly employed now in the treatment of dropsical diseases, in which it often effects remarkable benefits, particularly in renal dropsy. If of good quality,  $\frac{1}{4}$  to  $\frac{1}{2}$  gr., in pill, will operate briskly and rapidly, causing copious fluid stools, but it is better given in smaller doses,  $\frac{1}{8}$  gr., repeated every third hour until it takes effect.

A good combination is, Elaterium, gr. i., Acid tartrate of potassium, grs. xxx., Ginger, grs. ix. Of this powder, forty grains contain one gr. of elaterium: dose five to ten grs.

The dose of elaterin is  $\frac{1}{20}$  to  $\frac{1}{15}$  gr.

### ELEMI.†

*Origin.*—Elemi is a hardened resinous exudation, analogous to the turpentine, and obtained by incisions into the tree, which is probably *Canarium commune*, N. O. *Terebinthaceæ*. According to others it is derived from various species of *Icica* or *Amyris*, N. O. *Myricaceæ*.

*Characters.*—Easily known by its greenish-yellow waxy appearance, and its aromatic, peppery odour. It contains over 80% of resin, and about 12% of a clear volatile oil, and accordingly it is mostly soluble in rectified spirit.

\* The wild gourds which rendered the pottage poisonous, and whose effects the prophet Elisha prevented by adding meal to the mess, are held to have been elaterium fruits. (Strumpf, quoted by Stillé.)

† An Ethiopian term.

*In Medicine.*—Employed externally only in the form of Ointment, and, when mixed with an equal weight of Ung. Resinæ, it forms a capital “warm-dressing” for indolent sores, anthraxes, &c.

The Ung. Elemi is sometimes called *Balsamum Arcæi*, because a compound elemi ointment was introduced by Arcæus in 1654.

### EMPLASTRA.\*

Plasters are solid adhesive compounds intended for external application. The basis of most of the fourteen Plasters is either oxide of lead (litharge), resin, soap, or wax and fatty matters, and they are usually prepared for use by spreading the composition upon leather, linen, or paper. When kept in stock they are commonly shaped into cylindrical rolls, but when long kept many of them are apt to change colour and become hard and brittle.

The plasters in most frequent use are those of belladonna, cantharides, mercury, opium, lead, resin, and soap.

#### EMPLASTRUM AMMONIACI CUM HYDRARGYRO.

The only use of the sulphur is to aid mechanically in the fine division of the mercury. Probably a little inert sulphide of mercury is formed.

A stimulating application sometimes used in lymphatic swellings, housemaid's knee, nodes, and other indolent enlargements, especially when of a syphilitic nature. The mercury is sometimes absorbed in sufficient quantity to affect the gums.

#### EMPLASTRUM BELLADONNÆ.

A mixture of the alcoholic extract of belladonna with resin plaster.

\* Ἐμπλάσσω, to spread.

An useful anodyne application in neuralgic and rheumatic pains, in dysmenorrhœa, and in irritable states of the uterus. The constitutional effects of belladonna occasionally arise from the use of this plaster.

### EMPLASTRUM CALEFACIENS.

By the employment of the aqueous extract of cantharides instead of the powdered insects themselves, an equable distribution of the vesicant throughout the mass is ensured.

This, the popular "warm plaster," is an excellent rubefacient much employed in chronic rheumatism, bronchitis, and other affections. It is  $\frac{1}{8}$ th the strength of Empl. Cantharidis.

### EMPLASTRUM CANTHARIDIS.

This is essentially a solution of cantharidin in fatty matters, suet and lard. Under the name of "fly-blister" it is in extensive use as a vesicant, but its place is now to some extent supplied by the more cleanly and refined preparation, e. g. Charta Epispastica, and the non-official vesicating collodion. (See Cantharis.)

Blistering plaster contains eight times as much cantharides as warm plaster.

### EMPLASTRUM CERATI SAPONIS.

Differs little from the Empl. Saponis; it contains no resin. By mutual decomposition, oleate of lead and acetate of soda are formed. Used in dressing corns, strapping swelled joints, &c., but it is merely of mechanical service.

### EMPLASTRUM FERRI.

Commonly called "strengthening plaster" from an absurd impression that it really strengthens the parts to which it is



applied. It is, however, very adhesive. The oxide of iron is perfectly useless, and the effects of the plaster are essentially those of lead plaster, which forms  $\frac{2}{3}$ rd of its weight.

### EMPLASTRUM GALBANI.

A stimulating gum-resinous application. When heated by the patient's body it develops an unpleasant odour.

### EMPLASTRUM HYDRARGYRI.

The sulphur, as in the Empl. Ammon. cum Hydr., merely aids in the mechanical division of the mercury. Occasionally applied over venereal buboes, nodes, &c. In susceptible persons the mercury sometimes affects the gums. A complex modification of this plaster, termed *Emplastrum de Vigo* (containing twenty-three ingredients), has acquired some reputation as a local preventative of the pitting from small-pox. But, if such a dressing be desired, common mercurial ointment is much simpler and probably quite as effectual.

### EMPLASTRUM OPII.

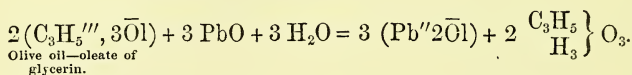
Extract of opium, as in the U. S. formula, is preferable to crude opium in the preparation of this plaster. It exerts a feeble local anodyne influence, contrary to what is observed with other narcotics, e. g. belladonna, and its utility is very limited.

### EMPLASTRUM PICIS.

This and the Empl. Calefac. are the only preparations which contain expressed oil (butter) of nutmeg. A rubefacient plaster, irritable to delicate skins, and used in chronic catarrh and in rheumatic pains in the joints and muscles.

## EMPLASTRUM PLUMBI.

Lead plaster is really a *soap*, i. e. a combination of a fatty acid with a metallic base. The decomposition which occurs in its preparation is as follows:—Olive oil is chiefly olein (oleate of glycerin), and, when heated with the oxide of lead (litharge) oleate of lead is formed, and glycerin is set free.\* Thus, lead plaster is strictly an insoluble oleate of lead containing an admixture of glycerin. Water is essential to the reaction as appears from the equation:



Too high a temperature must be avoided, which would decompose the oil, and reduce some of the oxide of lead.

*In Pharmacy.*—Lead plaster forms the basis of seven out of the fourteen official Plasters. It was formerly employed as a source of glycerin.

*In Medicine.*—Long in use under the name of *diachylon*,† as a sedative application to excoriated surfaces and to slight wounds. Lead colic has resulted from its long continued application to a large ulcer of the leg.

## EMPLASTRUM PLUMBI IODIDI.

Recommended in cases of scrofulous tumours and indolent ulcers.

It gradually becomes almost colourless from the action of the alkali in the soap plaster forming iodide of sodium. When made with resin plaster alone, or with a mixture of resin and lead plaster this decomposition does not occur.

\* Glycerin was discovered in 1783 by Scheele while preparing lead plaster.

† From *δαΐ*, through and *χυλός*, juice, i. e. a plaster prepared from expressed juices.

## EMPLASTRUM RESINÆ.

This, the common “sticking plaster,” is simply lead plaster, rendered more adhesive and stimulating by the addition of resin and soap.

Much used in the dressing of wounds, and in the strapping of ulcers, swelled testicles, &c.

## EMPLASTRUM SAPONIS.

Differs from the last only in having more soap, and less resin added to the lead plaster. It is more readily adhesive, and less brittle than resin plaster, and is preferred for use in some hospitals on account of being less irritating to the skin.

## ENEMATA.\*

Enemata (clysters—glysters—lavements) are substances in the liquid form intended to be injected into the rectum, with the view either of evacuating the bowels, of allaying irritation in the rectum or neighbouring organs, or of introducing food or medicinal substances into the system, when, from any cause, they cannot be administered by the stomach. The injection should be slowly and carefully performed, the tube being well oiled, and the quantity of fluid thrown in will vary with the age of the patient, and the object sought to be gained. An enema intended to *purge* an adult should not be less than ʒx. in bulk, on the average about a pint, and, in some cases, as much as four or even six pints may be given, as the bowels will sometimes act from the stimulus of distension, when insensible to other impressions. Hardened and impacted fæces sometimes form a serious obstacle to injections, and may require previous removal. A cathartic enema for a child, one or two years

\* 'Ενίημι, to inject; *clysters*, from κλύζω, to wash away.

old, should be from  $\text{ʒij.}$  to  $\text{ʒiv.}$  If the enema is to be retained, e. g. *Enema Opii*, it should not exceed  $\text{ʒi.}$  to  $\text{ʒij.}$  for an adult, and  $\text{ʒi.}$  to  $\text{ʒij.}$  for young children.

Enemata are an extremely valuable means of treating many affections, and succeed very frequently when medicines by the mouth fail, or are inadmissible; but much of their success, in some cases, depends upon the tact with which they are administered.

The employment of large enemata in dysentery, thrown in by means of a long flexible tube, was first proposed by Dr. O'Beirne, and is now in constant use in various other complaints. In many cases nutritive and stimulating enemata of beef tea, milk, eggs, &c., afford the means of sustaining and prolonging life in severe fevers, stricture of the œsophagus, cancer of the stomach, &c. Such injections, sooner or later, are sure to irritate the bowel, and to fail of being digested, and, as a better nutritive injection than any of these, Leube recommends a mixture of very finely minced raw meat, with about one-third of its weight of the pancreas of an ox or pig.

Gaseous matters, also, are sometimes forced up the rectum. The injection of air has been proposed in ileus, of carbonic acid gas in ulceration of the rectum, and tobacco smoke has been recommended in certain cases, e. g. hernia, but it is not a safe or advisable form of medication.

As a general rule, a larger dose of a medicine may be administered by the rectum than by the mouth; but caution is necessary in this respect, and it is probable that the relative susceptibilities of the stomach and rectum are not the same in all individuals. Of the six enemata, three, viz., aloes, sulphate of magnesia, and turpentine, are chiefly used for their purgative properties. The usual basis of enemata is some demulcent, e. g. thin starch paste, mucilage of barley, or gruel. Simple warm water enemata are often employed in cholera, spasm of the rectum, rigidity of the os uteri, &c.

## ENEMA ALOES.

The carbonate of potash renders the aloes more soluble. Used in cases of thread-worm (oxyuris) in the large intestines, and of amenorrhœa attended with constipation. Collections of thread-worms in the rectum are readily destroyed by enemata of salt, ferric chloride, lime water, or quassia; but as their real home is in the colon and cœcum, rectal medication alone will not suffice for their radical cure.

## ENEMA ASSAFŒTIDÆ.

This, the common "fœtid enema," is an emulsion of the gum-resin in water.

An excellent antispasmodic and carminative, often useful in hysteria, epilepsy, abdominal colic, and flatulency, especially when occurring in fever.

## ENEMA MAGNESIÆ SULPHATIS.

A serviceable cathartic enema in constipation, scybala, &c. One or two tablespoonfuls of common salt answer very well in stead of the Epsom salts. Its cathartic action may be increased by the addition of  $\text{ʒss.}$  of any purgative tincture, e.g. Tr. Sennæ.

## ENEMA OPII.

The most useful form of "anodyne enema," and an admirable remedy in obstinate vomiting, strangury, tenesmus, diarrhœa, &c. It is constantly employed to produce the narcotic effects of opium on the system, when that drug cannot well be given by the usual channel; or, in continued fever, to procure sleep, when full doses of opiates by the mouth have failed. Since it is intended to be retained the bulk is small. The supposition that

a much larger dose of opium is required by the rectum than by the mouth does not appear to be well founded.

### ENEMA TABACI.

A simple infusion of tobacco. It is a dangerous mode of administering tobacco, and is seldom employed now except in tetanus, and in strychnia-poisoning. Serious symptoms of depression would follow an overdose, and half the officinal enema is sufficient for one dose.

### ENEMA TEREBINTHINÆ.

Care should be taken that the turpentine be thoroughly incorporated with the starch mucilage, or else some irritation of the margin of the rectum may be caused.

In full quantity, an active and useful purgative in obstinate constipation; in smaller quantities, a capital anthelmintic and carminative. Frequently employed in the treatment of tympanites in continued fever, and in the removal of any of the varieties of worms from the intestines, and sometimes very useful in sciatica. If desirable, castor oil may be added to the injection. Mucilage of barley forms a very good vehicle.

### ERGOTA.\*

*Origin.*—Ergot is the diseased grain or seed of the common rye, *Secale cereale*, N. O. Gramineæ.

The cause of the disease is a parasitic mould or fungus, named *Claviceps purpurea*, which is found on and in the substance of the seed, and occurs also on other parts of the plant. It is, in fact, a condensed mushroom spawn. The mycelium or spawn is the vegetative part of the fungus, and, when ergot is produced under favourable conditions, the fungus developes into

\* French, *ergot*, a spur.



its mature form, viz., a cylindrical stalk terminated by a round head which encloses the fructification. Although its pathology has only recently been cleared up, ergot has an ancient history, and was first mentioned by Sigebert de Gremlour, who wrote in 1096, and recorded an epidemic of gangrenous ergotism.

The fungoid growth, which is particularly apt to develope in rainy seasons, can be inoculated on other grass-seeds before germination, and so give rise to ergotised fruit. Not only the rye-plant, but wheat, and, indeed, all grasses, some sedges (*Cyperaceæ*), and even palms are liable to this morbid growth, and, in the case of wheat at least, the peculiar medical properties of ergot of rye are preserved. Ergot of wheat is larger and harder, and ergot of oats is smaller than ergot of rye. The ergot of another grass (*Ampelodesmos tenax*), termed *diss* by the Arabs, has been proposed as a substitute for ergot of rye.

The ergot of rye usually projects from between the inner scales (*paleæ*) of the ear of grain in the form of curved spurs, and sometimes every individual seed is so diseased. It should not be collected until some days after it has begun to develope. Ergot is imported from Germany, France, and America.

*Characters.*—Ergot occurs as solid, brittle, tapering grains, averaging about one inch in length, and somewhat resembling the spur of a cock; hence the name, “spurred rye.” At one extremity is a grey excrecence, which, however, is generally rubbed off, and externally there is often a white bloom of the sporidia of the fungus. Ergot is inflammable, and burns with a bright jetting flame. The flavour of it is after a time disagreeable and acrid, and the odour, which is nauseous and mushroom-like, even in the unbruised grain, becomes very fetid when the powdered seed is rubbed up with liquor potassæ, owing to the liberation of a volatile alkaloid, viz., trimethylia,  $C_3H_9N$  (*secalia*), possessing somewhat the odour of herring brine. Trimethylia was long confounded with its isomer propylamine, which, however, cannot be obtained from ergot. The

production of this odour constitutes a test for ergot in corn flour. In the cases of hemlock, ergot, and tobacco, severally, a peculiar fetor is developed by trituration with potash, due in each instance to the evolution of a volatile base, viz., conia, trimethylia, and nicotia.

Besides phosphate of trimethylia, ergot contains 34% of a fluid fixed oil, stated to be poisonous, starch, gum, sugar (mycose), and resin. Under the common, but vague, designation, *ergotin*, it is to be borne in mind, that no less than three distinct substances are included, viz., Wiggers' *ergotin* (1831), insoluble in water; Bonjean's *ergotin* (1840), soluble in water and spirit; and Wenzell's *ergotin* (1864), soluble in water. What is commonly called "*ergotin*" in these countries is nothing but a concentrated watery extract of ergot, and, in short, as matters stand at present, it is impossible to give a satisfactory answer to the question—what is the active principle of ergot?

Ergot, when exposed to air and moisture, especially if in powder, rapidly deteriorates, acquires the odour of rotten fish, and becomes attacked by a species of *acarus*. It should be powdered only when required for use, and should always be kept perfectly dry, and in well stoppered bottles. Camphor, cinnamon, acetic acid, sugar, &c., are recommended as preservatives.

*In Pharmacy.*—Ergot yields its virtues to water (Extract and Infusion) and to spirit (Tincture). The infusion is dark claret-coloured, has an acid reaction, and is precipitated by the acetates of lead, nitrate of silver, and by tincture of galls.

*In Medicine.*—In excessively large doses ergot acts as a narcotic poison, producing giddiness, depression of the pulse, dilatation of the pupils, delirium, and even stupor. But even in smaller quantities, e. g. in ergotised bread, its long-continued use is highly dangerous although no bad effects be immediately perceptible. This chronic poisoning, or *ergotism*, manifests itself chiefly either as paralysis and dry gangrene of the extremities, or, as a convulsive disease of the nervous system, and fatal epide-

mies (*ignis sacer, pestis ignaria*), especially in France, have been ascribed to this cause. In one epidemic, in Wurtemberg, out of 500 patients 300 children under fifteen years of age perished. If ergot occurs in the pastures where cattle feed, it is said to occasion dry gangrene, causing the cattle to lose their hoofs and horns. Dogs show a remarkable aversion to food containing ergot, and even pigs dislike it.

Broadly speaking, ergot is a stimulant to unstriated muscular fibre generally, but its most important influence is that exerted upon the pregnant uterus which it incites to a steady continued action, rather than that alternation of contraction and relaxation which is observable in natural labour. It cannot be used with safety unless the os uteri be sufficiently dilated, the presentation natural, and the pelvis free from deformity. It is also serviceable in expelling retained placenta, clots of blood, hydatids, &c., when the uterus has once begun to act.

Some practitioners believe ergot to exert a dangerous influence upon the life of the fœtus by subjecting it to powerful and continuous uterine pressure and by weakening its heart, but probably much of this fear is to be ascribed to the practice of using ergot in too large doses. Ergot has been frequently administered with success to quadrupeds in cases of difficult or protracted parturition.

In uterine hemorrhage, unconnected with pregnancy, it is likewise very useful, and since it is found to cause contraction of the small arterioles, it is highly recommended in other forms of hemorrhage, and in purpura, and seems to be the most powerful means of checking pulmonary bleeding. By a similar action on the blood-vessels of the spinal cord it is beneficial in certain cases of paraplegia, those, namely, which depend upon congestion of the cord, and is of course contra-indicated in anæmic conditions of the cord as Brown-Séquard has pointed out.

In some cases of paralysis of the bladder and intestinal canal ergot proves itself a valuable remedy, and in some forms of

nerve pain, especially sciatica, the internal use of ergot is frequently serviceable. It is stated that the habitual use of ergotised bread causes suppression of milk, and in cases of profuse galactorrhœa, cures have been obtained by the use of ergotin (Bonjean's) internally. Latterly, the so-called ergotin (Bonjean) has been frequently administered hypodermically, dissolved in glycerin and water, in doses of three grs. and upwards, and has recently been applied to the resolution of uterine fibroid tumours, and to the solidification of small aneurisms and of varicose veins.

*Administration.*—Ergot is usually given in Infusion which must be made fresh. Dose  $\bar{3}$ i. to  $\bar{3}$ ij. (= ten to twenty grs. ergot). Of the Tincture, thirty m. are a fair dose, and of the Liquid Extract, ten to fifteen m.

The dose of Wiggers' ergotin is from three to five grs.

### ESSENTIÆ.

An essence is a *concentrated* solution of an essential or volatile oil in rectified spirit, and simply differs from a medicinal "Spirit," e. g. Sp. Menth. Pip. in being much stronger. Each of the essences contains one part of the volatile oil in five.

### ESSENTIA ANISI.

An aromatic carminative. Two other preparations contain oil of anise, viz.:—English (Tr. Camph. Co.) and Scotch (Tr. Opii Ammon.) paregoric.

### ESSENTIA MENTHÆ PIPERITÆ.

Is ten times as strong as Spir. Menth. Pip. It affords a good means of covering the taste of rhubarb and other nauseous drugs.

*EXTRACTA.*

An “extract” is a solid vegetable\* substance, usually of pilular or tenacious consistence, and resulting from the evaporation of the expressed juice of the plant, or of a solution of its active principles.

Extracts are convenient preparations representing in small bulk the active ingredients of medicinal plants. They are necessarily complex in composition, and vary much in quality, according to the nature of the vegetable, the mode of preparation, and the care taken in preserving them. The older chemists supposed that all extracts contained one peculiar principle, which they called “extractive;” but this term has no definite meaning, and should be discarded.

Thirty-six extracts are officinal:—Two, viz., Extr. Mezer. Æther. and Extr. Physostigm., were introduced into the B. P., 1867; and three, viz., Extr. Lactucæ, E. Papav., and E. Pareiræ, were restored from the London and Edinburgh Pharmacopœias.

*Preparation.*—There are two distinct methods of extracting the valuable portion of vegetables, according as the plant is in a fresh or dried state. In the former case, we make use of mere expression; in the latter, of some solvent.

I. *Expression.*—The following are prepared by pressure:—Aconitum, Belladonna, Colchicum, Conium, Hyoseyamus, Lactuca, and Taraxacum. They are all, except Colchicum (corm), and Taraxacum (root), derived from the leaves and branches, and mostly from acrid or narcotic plants. The chlorophyll or green colouring matter is first coagulated by a temperature of 130°, and set aside for subsequent addition, for the sake of appearance, to the extract. The albumen is then coagulated by a higher temperature (200°), and rejected, because it is inert, and tends to putrefaction. These extracts are sometimes collectively

\* Ox-bile is sometimes termed extract of bile.

called the inspissated juices, or *green extracts*; but it is manifestly erroneous to take, as has been proposed, the colour of these preparations as any test of their excellence.

II. *Solution*.—The menstruum usually employed is either water or alcohol, or a mixture of the two. Alcohol is requisite whenever the principles to be extracted are insoluble, or nearly so, in water, such as resin (Indian hemp), alkaloid (nux vomica, physostigma), &c. Sometimes it is necessary to submit the drug to the action of alcohol and water successively, as in the cases of jalap and hop. In the “liquid extracts” a little alcohol is added to the aqueous extract for the purpose of preservation. While evaporating the solutions the lower the temperature the better, provided the time be not protracted too long so as to cause some chemical change. In a warm and very dry atmosphere artificial heat may be dispensed with, and the best of all methods is evaporation *in vacuo*. As a general rule, extracts should not be employed when more than one year old.

The various solvents employed are—

(a). *Water*.—The aqueous extracts are—Aloes (2), Anthemis, Bela, Calumba, Cinchona, Ergota, Gentiana, Glycyrrhiza (2), Hæmatoxylum, Krameria, Opium, Papaver, Pareira (2), Quassia, and Sarsa. In the liquid extracts of bael, ergot, and pareira, each fluid part represents a solid part of the drug employed, i. e. their strength is one in 1.

(b). *Rectified spirit* is used with Cannabis Indica, Jalapa, Lupulus, Mezereum, Nux vomica, and Physostigma.

(c). *Proof spirit* is employed with Colocynth and Stramonium.

(d). *Acetic acid* is used in Extr. Colch. Acet. only.

(e). *Ether* is used as the solvent of the active oily principle in Fern and Mezereum; but with Ergot and Stramonium it is employed with the object of previously removing from the preparation a fixed oil.

*General Characters*.—Extracts are usually soft, so that they may



be made into pills ; but some become so hard that they require to be pulverised, e.g. Ext. Hæmatoxyli. In some cases the solution is not evaporated to dryness, or else the purified solid extract is redissolved in water, constituting the "liquid extracts," e.g. Extr. Opii Liq. Mould not unfrequently forms upon the surface of extracts, and also small crystals of saline matter, chiefly chloride and nitrate of potassium, and occasionally sulphate of sodium. Some extracts, e.g. aconite and belladonna, have an acid reaction ; others, e.g. hemlock, are more or less alkaline. Again, a few, e.g. belladonna and lettuce, contain glucose, or a glucoside, which may be detected by Barreswil's cupro-potassic solution.

Extracts, especially the softer ones, should be carefully kept in a cool dry place, and protected from the air, for they are liable to ferment, and become mouldy, particularly the extracts of narcotic plants.

If starch have been fraudulently added, it can be detected by boiling the extract in water, and adding iodine to the cooled decoction. Traces of copper are occasionally present, derived from the vessels in which they had been prepared. To detect it, incinerate, dissolve the ash in nitric acid, and apply the usual tests for copper.

It is not always possible to recognise with certainty a given extract; but, in some cases, a characteristic odour is exhaled on the addition of sulphuric acid or caustic potash.

The *dose* of aqueous extracts is about one-half to one-quarter that of the original drug; but, in the case of alcoholic extracts, e.g. Extr. Physostigm., the dose is usually much smaller,  $\frac{1}{8}$  to  $\frac{1}{10}$  gr. Extracts are generally administered in pill, of which they frequently constitute the main ingredient; but they are sometimes dissolved in a mixture.



## EXTRACTUM ACONITI.

Is one of the green expressed extracts, and the process consists essentially in the evaporation of the expressed juice. One pound of fresh aconite yields from one to one and a half ounces of extract. This preparation has a disagreeable narcotic odour and the peculiar acrid taste of the plant.

## EXTRACTUM ALOES BARBADENSIS.

## EXTRACTUM ALOES SOCOTRINÆ.

These preparations differ but little in activity from the original drug, and are quite unnecessary. Given in doses of  $\frac{1}{4}$  to  $\frac{1}{2}$  gr. every four hours these extracts will frequently act well as a purgative.

## EXTRACTUM ANTHEMIDIS.

Some volatile oil of chamomile is added at the end of the process to compensate for that lost in the processes of boiling and evaporation; three parts of chamomile yield about one of extract. This compound is of a deep brown colour, with the bitter aromatic taste of the flowers, and is chiefly used as a vehicle for other medicines in the pilular form.

## EXTRACTUM BELÆ LIQUIDUM.

The rectified spirit is added as a preservative against decomposition. Strength, one in 1.

## EXTRACTUM BELLADONNÆ.

A soft dark brown preparation with a heavy narcotic odour. The fresh plant yields 5 to 10% of extract. A convenient form for the local application of belladonna, but, in most cases, the more cleanly Liniment of belladonna may with advantage be

substituted. If of good quality, two or three grs. will produce the characteristic physiological effects of belladonna. Made up into the forms of Plaster and Ointment it is also frequently used.

### EXTRACTUM CALUMBÆ.

Cold water is used in order to avoid extracting the starch so abundantly present.

### EXTRACTUM CANNABIS INDICÆ.

A dark green resinous extract, and accordingly rectified spirit is necessary in preparing it. Characterised by its peculiar odour, and by being converted by strong warm nitric acid into an orange-yellow substance. Redissolved in rectified spirit it constitutes Tr. Cann. Ind.

### EXTRACTUM CINCHONÆ FLAVÆ LIQUIDUM.

An extremely concentrated solution;  $\mathfrak{z}\text{i}$ . represents four ounces of yellow bark. One-fourth part of rectified spirit is added for the purpose of preservation. To detect quinia in it—add to the solution a little ammonia and then ether, decant, evaporate, dissolve the residue in dilute sulphuric acid, re-precipitate with ammonia, and test for quinia as usual with chlorine and ammonia.

### EXTRACTUM COLCHICI.

### EXTRACTUM COLCHICI ACETICUM.

The fresh corm is directed to be used, and the acetic acid is considered to exhaust the plant more thoroughly, but there is no occasion for two extracts of the same drug. The taste of either extract should be very bitter. Treated with ether or chloro-

form, the solution should give a blue colour with strong sulphuric acid.

### EXTRACTUM COLOCYNTHIDIS COMPOSITUM.

Sometimes called "cathartic extract." An energetic and safe cathartic, often advantageously combined with other purgatives such as calomel, croton oil, &c. It contains about half as much resin of scammony as Pil. Coloc. Co.

### EXTRACTUM CONII.

Variable in strength, and almost valueless as a medicine. It is impossible to prepare an extract which includes more than 1% of conia (J. Harley); any conia which it may contain will be liberated upon the addition of solution of potash, as in Vapor Coniæ, but the heat employed in the preparation of the extract destroys most of the conia.

### EXTRACTUM ERGOTÆ LIQUIDUM.

A concentrated aqueous solution of ergot preserved from change by the addition of an equal bulk of rectified spirit. The first step in the process is to dissolve out the fixed oil by means of washed ether. Strength, one in 1. The addition of potash to the solution developes a strong, fishy odour of trimethylia.

### EXTRACTUM FILICIS LIQUIDUM.

An ethereal solution of the oleo-resinous matter of fern, and is commonly called *oil of male fern*. It is a thick dark liquid which gradually deposits a green sediment. This preparation is the best form of administering fern, as well as the most certain anthelmintic agnaist the tapeworm.

## EXTRACTUM GENTIANÆ.

A dark brown, bitter solid, frequently used as a tonic and as the basis of pills.

## EXTRACTUM GLYCYRRHIZÆ.

Well known under the name of "liquorice," and used for covering the taste of nauseous drugs, e. g. senna, aloes, and sal-ammoniac, which it is particularly well calculated to do. It should dissolve in water without leaving any sediment; the inferior kinds are often much adulterated. The best imported extract bears the brand "Solazzi."

## EXTRACTUM GLYCYRRHIZÆ LIQUIDUM.

A simple aqueous solution of the soluble matters of liquorice-root, a little rectified spirit being added to prevent fermentation. A convenient preparation useful for disguising nauseous flavours.

## EXTRACTUM HÆMATOXYLI.

A brittle, deep ruby-coloured solid, usually hard. Iron vessels should not be used in its preparation on account of the presence of tannic acid in the logwood. Six parts of logwood yield about one of extract. Best given in solution, for, on account of its hardness, it is not suited for the pilular form.

## EXTRACTUM HYOSCYAMI.

A soft, dark, olive-coloured solid with a heavy unpleasant odour. One part of extract is obtained from sixteen or twenty parts of fresh henbane. When long kept, crystals of nitrate of potassium and chloride of sodium form on the surface. Like all the inspissated juices it is variable in strength.

## EXTRACTUM JALAPÆ.

An aqueo-spirituos extract of a dark brown colour, apt to attract moisture from the air. It contains the resin and gummy matter of jalap, and cold water is used in the process to avoid extracting the starch. Two parts of jalap yield about one of extract. Not often used by itself.

## EXTRACTUM KRAMERIÆ.

A dark brown astringent extract, usually hard, which colours the saliva red. Its aqueous solution is coloured greyish-brown by ferrous and ferric salts and gives with the mineral acids, after some hours, a voluminous pink precipitate.

## EXTRACTUM LACTUCÆ.

A sedative and feebly narcotic extract, sometimes used as an adulterant of opium, which it superficially resembles.

## EXTRACTUM LUPULI.

An aqueo-spirituos extract. Lupulin may be advantageously substituted for it.

## EXTRACTUM MEZEREI ÆTHEREUM.

A soft spirituous-ethereal extract, only used externally as a counter-irritant, and enters into the mustard liniment, in the proportion of eight grs. to  $\bar{3}$ i. It is costly and quite unnecessary.

## EXTRACTUM NUCIS VOMICÆ.

The nux-vomica is so hard that it must be steamed and dried before it can be powdered. This extract is a good form for giving



strychnia, but it is not always of uniform strength. Sixteen parts of nux-vomica yield about one part and one-fourth of extract, which is characterised by its excessively bitter taste, and by nitric acid turning its watery solution orange-yellow. To detect strychnia in it, add a drop of ammonia to its spirituous solution, and then a little ether or fousel oil. On evaporation of the ethereal solution, the residue will give the characteristic violet colour with sulphuric acid and bichromate of potassium.

### EXTRACTUM OPII.

An aqueous extract, said to agree better with some individuals than crude opium, or its alcoholic preparations. Three parts of opium yield about two of extract, which, therefore, should contain about 10 or 15% of morphia.

To detect this alkaloid:—Dissolve one gr. in a little water, add a few drops of solution of iodic acid, and shake up with bisulphide of carbon. In a few moments this will assume a rose colour, and free iodine will be evidenced by starch paper. No other alkaloidal extract will decompose iodic acid (Lepage).

This preparation, formerly called *Thebaic extract*, sometimes presents a granular aspect due to the presence of crystals of meconates of morphia and potassium.

### EXTRACTUM OPII LIQUIDUM.

Consists simply of the preceding preparation, redissolved in water, and preserved by the addition of rectified spirit. It is stronger than laudanum (22 m. = 25 m.), and may be considered as the officinal representative of "Battley's sedative liquor," which, however, is slightly stronger than the liquid extract.

## EXTRACTUM PAPAVERIS.

So feeble and uncertain in its anodyne powers, that there is no good purpose served in retaining it. If prepared from a decoction, instead of an infusion, of poppy-heads, it would contain a considerable quantity of inert mucilaginous matter.

## EXTRACTUM PAREIRÆ.

A simple aqueous extract, but is not often prescribed.

## EXTRACTUM PAREIRÆ LIQUIDUM.

A concentrated infusion, preserved by rectified spirit. Strength one in 1.

## EXTRACTUM PHYSOSTIGMATIS.

A recent, and very active preparation, soluble in water and glycerin. One hundred parts of the bean yield about four of extract.

## EXTRACTUM QUASSIÆ.

A very bitter aqueous extract; a good excipient for pills.

## EXTRACTUM RHEI.

An aqueo-spirituos extract, reddened on the addition of alkalies.

## EXTRACTUM SARSÆ LIQUIDUM.

A concentrated aqueous solution, preserved by rectified spirit. Not affected by ferric salts.

## EXTRACTUM STRAMONII.

An alcoholic extract of the seeds, more efficient than if made from the leaves. The seeds are first treated with washed ether

to remove a fixed oil, as in the case of Extr. Ergotæ Liq. Cubical crystals of chloride of potassium sometimes form on this extract.

### EXTRACTUM TARAXACI.

An inspissated juice, analogous in its preparation to Extr. Colchici. About four parts of fresh root afford one of extract.

### FARINA TRITICI.

*Origin.*—Ordinary flour is the powdered husked seeds of the wheat plant, *Triticum vulgare*, N.O. Gramineæ. The husk or seed-coat is separated from the flour by sifting, and constitutes bran, which forms about one-fourth of the weight of the seeds. The native country of wheat is not certainly known; but it is now freely cultivated in almost every temperate climate.

*Composition.*—The chief constituents of flour, in the order of their quantity, are starch (*Amylum*), 70%; gluten and albuminous matter, about 16%; water, sugar, and gum; and of mineral matter, phosphates of sodium, calcium, and magnesium.

By kneading with cold water in a cloth, the gluten, and any trace of bran, remain behind; the albumen, sugar, and gum dissolve in the water, and the starch passes through the pores of the cloth, being merely suspended in a state of fine division in the liquid. (See *Amylum*.)

Wheaten flour is subject to many adulterations, such as mineral matter, water, and other starchy materials especially potato-starch.

*In Pharmacy.*—Is a constituent of the yeast, or fermenting poultice, a deodorising application to foul and sloughing ulcers. Bread crumb (*Mica Panis*) is an ingredient of the charcoal poultice, and is occasionally used in making up pills, e. g. nitrate of silver.

*In Medicine.*—Flour is sometimes dusted over the skin in erysipelas, and in itchy and burning eruptions, and, mixed with honey, it forms a simple and useful dressing for boils. It is also sometimes recommended as an antidote to corrosive sublimate, and other irritant salts. Toast-water is a nutritive drink, acceptable in febrile complaints. With milk or water, bread makes an excellent emollient poultice, to which a little lard may be added, or, often with advantage, lead lotion. Bran, as in brown bread, is a mild laxative; well softened in warm water, it makes a good emollient application to soothe an irritable skin, and to remove crusts and scales.

Flour makes a more tenacious paste with water than starch, on account of the presence of gluten.

### FEL BOVINUM PURIFICATUM.

*Origin.*—Fresh ox-bile is a viscid greenish fluid, containing, in addition to the proper biliary matter, a quantity of mucus from which it is necessary to free it, in order to avoid putrefaction.

*Preparation.*—Agitate the bile with twice its bulk of rectified spirit, which dissolves the biliary substances, and coagulates mucin. Filter and evaporate to a pilular consistence.

*Characters and Tests.*—The purified bile is a dark green solid, whose watery solution should give no precipitate with rectified spirit, showing its freedom from mucus. It is hygrometric.

The essential constituents of bile, are (1) colouring matter; (2) cholesterin, a common ingredient of biliary calculi, from which it may be separated by ether in white glistening scales; (3) two crystalline sodium salts, viz., glyco-cholate,  $\text{NaC}_{26}\text{H}_{42}\text{NO}_6$ , and tauro-cholate,  $\text{NaC}_{26}\text{H}_{44}\text{NO}_7\text{S}$ . Glyco-cholic acid is a conjugated acid, composed of cholic acid,  $\text{H}_2\text{C}_{14}\text{H}_{29}\text{O}_5$ , and glycocin or sugar of gelatin,  $\text{C}_2\text{H}_5\text{NO}_2$ , while tauro-cholic

acid, similarly, is composed of cholic acid, and taurin,  $C_2H_7NO_3S$ , a body containing  $\frac{1}{4}$  of its weight of sulphur.

*Pettenkofer's test* for the bile-acids consists in the addition of a drop of syrup and of sulphuric acid cautiously added, when a fine purplish red tint is produced, changing soon to a dirty red. A gentle warmth is often necessary to develop the colour, but too great heat or an excess of sulphuric acid will char the bile and spoil the test.

*In Medicine.*—Supposed to be tonic and laxative, and at one time highly esteemed, but rarely employed now. If given, it is prescribed in pill, in doses of five grs. and upwards.

## FERRUM.

### TABLE OF THE COMPOUNDS AND PREPARATIONS OF IRON IN THE PHARMACOPŒIA.

#### CLASS I.—METALLIC.

1. Ferrum (iron wire or nails),      Fe.
2. Ferrum Redactum,                  Fe (at least 50%) +  $Fe_3O_4$ .  
Trochisci Ferri Redacti; one gr. in each.

#### CLASS II.—OXIDES.

3. Ferri Oxidum Magneticum,       $Fe_3O_4$  ( $Fe_2O_3$ , 71% +  $FeO$ , 9% +  $H_2O$ , 20%).
4. „ Peroxidum Humidum,       $Fe_2O_3$ ,  $H_2O$  + 86% free water.
5. „ „ Hydratum,       $Fe_2O_3$ ,  $H_2O$ .  
Emplastrum Ferri.

#### CLASS III.—HALOID SALTS.

6. Ferri Iodidum,                       $FeI_2$ .  
Pilula Ferri Iodidi,                  3½ grs. = 1 gr.  $FeI_2$ .  
Syrupus „ „                          5 i. = 4·3 grs.  $FeI_2$ .

7. Ferri Perchloridi Liquor Fortior, 3 i. = 31·7 grs.  $\text{Fe}_2\text{Cl}_6$ .  
     Liq. Ferri Perchloridi, } 3 i. = 7·9 grs.  $\text{Fe}_2\text{Cl}_6$ .  
     Tinct. „, „, }
8. Ferri Sulphidum, FeS. App. I.

## CLASS IV.—OXYSALTS.

A. *Inorganic Acids.*

9. Ferri Arsenias,  $\text{Fe}_32\text{AsO}_4$ .  
 10. „ Carbonas Saccharata,  $\text{FeCO}_3$ .  
     Mistura Ferri Composita, 3 i. = 1·5 grs.  $\text{FeCO}_3$ .  
     Pilula „ Carbonatis, 2·5 grs. = 1 gr.  $\text{FeCO}_3$ .  
 11. „ Pernitratiss Liquor,  $\text{Fe}_26\text{NO}_3$ .  
 12. „ Persulphatis „  $\text{Fe}_23\text{SO}_4$ .  
 13. „ Phosphas,  $\text{Fe}_32\text{PO}_4$ .  
     Syrupus Ferri Phosph. 3 i. = 1 gr.  $\text{Fe}_3 2\text{PO}_4$ .  
 14. „ Sulphas,  $\text{Fe SO}_4, 7\text{H}_2\text{O}$ .  
     Pilula Aloes et Ferri, 7 grs. = 1 gr.  $\text{FeSO}_4, 7\text{H}_2\text{O}$ .  
 15. „ Sulphas Exsiccata,  $\text{FeSO}_4, \text{H}_2\text{O}$ .  
 16. „ „ Granulata,  $\text{FeSO}_4, 7\text{H}_2\text{O}$ .  
     Solution of Sulphate of Iron. App II.

B. *Organic Acids.*

17. Ferri Acetatis Tinctura,  $\text{Fe}_26\text{C}_2\text{H}_3\text{O}_2$ .  
 18. „ et Ammoniae Citras,  $\text{NH}_4\text{FeOHC}_6\text{H}_5\text{O}_7, \text{H}_2\text{O} (?) \text{Fe}_2\text{O}_3 = 27\%$ .  
     Vinum Ferri Citratis, 3 i. = 1 gr. Ferri et Amm. Citr.  
 19. „ et Quiniae Citras, Quinia = 16%.  
 20. Ferrum Tartaratum,  $\text{KFeOC}_4\text{H}_4\text{O}_6 (?) \text{Fe}_2\text{O}_3 = 30\%$ .  
     Vinum Ferri.  
 21. Ferrum Tannicum occurs only in  
     Mist. Ferri Aromatica.

Nos. 18, 19, 20, are sometimes called the “scale preparations” of iron, from the form in which they usually occur. They do not crystallise, and consequently some uncertainty hangs over their precise chemical constitution.



In addition to the compounds enumerated above, iron occurs in a peculiar, latent state of combination in the ferro-and ferrid-cyanides of potassium. In these salts the iron cannot be directly detected by the usual tests, neither do they act as blood-restorers.

*Source.\**—Iron is the most abundant and useful of the metals, and occurs not only in the mineral kingdom extensively, but also in animals (blood), and is found in the ashes of most plants. Its ores fall chiefly under two heads, viz.:—(1.) Oxides—*Magnetic iron ore, specular iron, hæmatite*; (2.) Carbonate—*Clay ironstone, Black band*. Iron pyrites,  $\text{FeS}_2$ , is used only for the sake of its sulphur, and is employed in the manufacture of sulphuric acid. (See Acidum Sulphuricum.) Iron spas, or chalybeate springs, contain generally ferrous carbonate, dissolved by excess of carbonic acid gas, or sometimes ferrous chloride or sulphate.

Iron is an essential ingredient, although in small quantity, of the hæmoglobin of the red corpuscles of the blood, and can be detected in their solution by first passing in chlorine, evaporating off excess of chlorine, and then adding ferrocyanide of potassium, when Prussian blue will be thrown down. (Engelhardt).

*Chemical Relations.*—Iron is a hard, malleable, and ductile metal, of great tenacity. Sp. gr. 7.7. Exposed to moist air it becomes covered with a reddish layer, *rust*, which is mainly hydrated sesquioxide.

Certain other metals are closely allied to iron, and manganese has been proposed as a therapeutic substitute for iron.

Two distinct classes of compounds are formed by iron, viz.:—(a) Those in which the iron acts as a dyad (i. e. combines with

\* A brief sketch of the general attributes of the iron preparations will be first given, and then all the officinal compounds will be described alphabetically.

not more than two atoms of a monad, such as Cl or I). These are termed the *ferrous* or *proto*-salts. (b) Those in which the group  $\text{Fe}_2^{\text{vi}}$  exists, acting with hexad power\* (i. e. requiring six atoms of a monad, or three of a dyad to saturate it). These are termed the *ferric*, *per*, or *sesqui*-salts.

No ferric compound includes but a single atom of iron.

The contrast between the formulæ and characters of these two classes of bodies will better appear from the subjoined table of some of the officinal preparations:—

FERROUS (PROTO).  $\text{Fe}^{\text{ii}}$

$\text{Fe O}^\dagger$   
 $\text{Fe I}_2$   
 . . . . .  
 $\text{Fe S}$   
 . . . . .  
 $\text{Fe}_3 2\text{AsO}_4$   
 $\text{Fe CO}_3$   
 . . . . .  
 $\text{Fe SO}_4$   
 $\text{Fe}_3 2 \text{PO}_4$

Blue precipitate (Turnbull's blue), with the *red* prussiate of potash.‡

FERRIC (PER. SESQUI.)  $(\text{Fe}_2)^{\text{vi}}$

$\text{Fe}_2 \text{O}_3^\dagger$   
 $\text{Fe}_2 \text{Cl}_6$  . . . .  
 $\text{Fe}_2 6 \text{C}_2 \text{H}_3 \text{O}_2$   
 . . . . .  
 $\text{Fe}_2 6 \text{NO}_3$   
 $\text{Fe}_2 3 \text{SO}_4$   
 . . . . .

Blue precipitate (Prussian blue), with the *yellow* prussiate of potash.‡

Ferrous (proto) salts are commonly of a lighter colour, less astringent, and less soluble in alcohol (See Ferri Sulph. Granul.); while the ferric (per) salts are generally brownish yellow, more astringent, and are soluble in alcohol, e. g. Tinct. Ferri Perchloridi.

\* Some chemists believe that iron is in the triad state in the ferric salts, thus  $2 \text{Fe}^{\text{iii}}$

† The two oxides combined form magnetic oxide,  $\text{Fe}_3\text{O}_4$ .

‡ Yellow prussiate of potash precipitates *pure* ferrous salts white, rapidly turning blue. Red prussiate simply darkens the colour of ferric salts, but causes no precipitate.

All the officinal ferric compounds, except peroxide of iron, are soluble in water.

Ferrous salts have a marked tendency to absorb oxygen from the air, and become converted into ferric compounds. Pure sugar preserves them from this change, e. g. Syrupus Ferri Iod., and Ferri Carb. Sacch. A *pure* protosalt of iron is difficult to obtain or to preserve, and hence most of the officinal ferrous salts are described as being *partially oxidised*, e. g. Ferri Arsenias. Accordingly they usually afford precipitates both with the yellow and the red prussiate of potash.

Ferric salts are not prone to change, and are turned blueish black by gallic and tannic acids. These acids do not immediately discolour ferrous salts. Ordinary writing ink is gallo-tannate of iron.

*Action of Acids.*—Iron is readily acted on by hydrochloric, sulphuric, or nitric acids, which give rise to their respective salts, and liberate, in the two former cases, hydrogen, and, in the latter, nitric oxide gas.

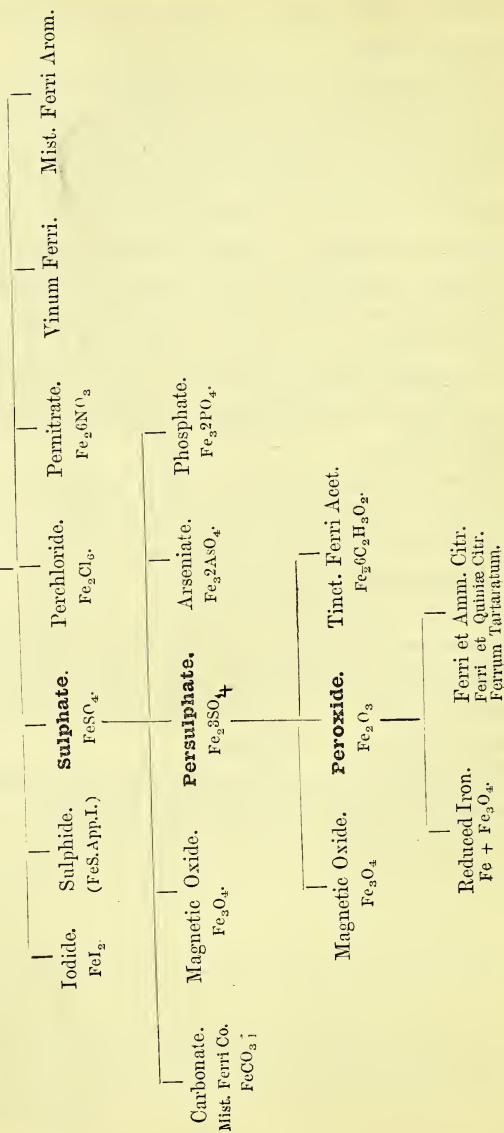
Iodine readily dissolves metallic iron (but not its oxides) in the presence of moisture, see Ferri Iod., and Ferrum Redactum.

The *soluble* salts of iron are usually prepared by direct solution of iron wire in the appropriate solvent, e. g. iodide, chloride, nitrate, and sulphates.

The *insoluble* compounds are prepared by double decomposition, e. g. carbonate, arseniate, and phosphate.

# GENEALOGICAL TABLE OF THE IRON COMPOUNDS.

From wrought-iron wire, "**Ferrum**," are prepared:—



*Quantitative Estimation.*—Ferrous salts are easily converted into ferric salts by any oxidising agent, such as nitric or chromic acid; and the principle of the volumetric process (Penny's method) of the Pharmacopœia for estimating iron, consists in ascertaining how much of a standard solution of bichromate of potassium is requisite to completely peroxidise a given weight of the ferrous compound in *acid* solution. It is known that all the ferrous salt is so peroxidised when a minute drop removed from the solution *ceases* to give a blue precipitate with the red prussiate of potash on a white plate. Since one molecule of bichromate is known to have three atoms, and only three, of available oxygen, it will necessarily peroxidise six molecules of any ferrous salt, for  $2 \text{FeO} + \text{O} = \text{Fe}_2 \text{O}_3$ . And as the standard bichromate solution (see App. III.) contains, for convenience, only one-twentieth of  $\text{K}_2\text{Cr}_2\text{O}_7$  in 1000 grain-measures, that amount will be capable of peroxidising one-twentieth of  $\text{Fe}_6$  (i. e. 16·8 grs.:  $\text{Fe} = 56$ ) in the state of ferrous salt.

*Gravimetrically*, iron is estimated by converting it into a ferric salt, if not so already, by nitric acid, and precipitating ferric oxide with an alkali, e. g. ammonia, or, in the case of the citrates and tartrate of iron, with caustic soda. Alkalies are incomplete precipitants of ferrous salts.

*General Therapeutical Effects.*—The preparations of iron, when given internally in moderate doses, are essentially hæmatics, i. e. are capable of improving the quality of the blood when impoverished by disease or copious losses. But it is very noteworthy that, in many cases, much larger quantities are absolutely necessary to effect a cure than would be imagined from the minute amount of iron actually present in the blood. They are also eminently tonic, and many of them are powerful astringents. Taken in the aggregate, they are more wholesome, and less poisonous than any other metallic combinations.

As tonics and hæmatics, the compounds of iron are largely employed in anæmia, and especially in chlorosis, scrofula,

rickets, passive hemorrhage, and in certain cases of dyspepsia and neuralgia. In fact, the specific treatment for chlorosis is iron, and its use must be steadily persevered in, with occasional intermissions. It is important to remember that iron exercises a distinct and direct influence upon the nervous system, independently of its hæmatic power, and is of great service in some chronic nervous affections, e. g. chorea and epilepsy. Injudiciously employed, or in over-doses, iron is apt to cause constipation, headache, thirst, and undue excitement of the circulation, and some persons cannot tolerate it at all. Iron is *contraindicated* in plethoric habits, and in congestive or extreme inflammatory conditions of the system. Trousseau and Pidoux declare that they have several times seen patients, whose death they imputed to the intemperate use of chalybeate preparations.

Iron as a hæmatic is best given with the meals, and not on an empty stomach; and metallic iron, and its insoluble preparations, or its compounds with the vegetable organic acids, seem to be more easily borne than when the iron is combined with a mineral acid, such as sulphuric or phosphoric acid. The mineral acid compounds are more astringent locally, particularly the perchloride, perntrate, and persulphate.

Further than these general statements we are not warranted in ascribing peculiar virtues to particular salts of iron. In many cases combination with purgatives greatly increases the efficacy of the salts of iron, and the Pil. Aloes et Ferri offers an eligible form of administration.

The persalts are reduced to protosalts in the organism.

Iron compounds, taken internally in full doses, render the stools black and offensive, owing, it is said, to the ferrous sulphide formed in the intestines by the sulphuretted hydrogen of the residual alimentary matters, or to tannate of iron, arising from tannin introduced through food (tea) or medicine.

The tongue likewise is often blackened, and the teeth are apt



to become discoloured, especially when the breath contains sulphuretted hydrogen arising from carious teeth.

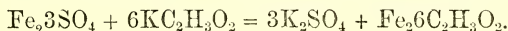
After absorption, iron has been detected in the blood, urine, and milk, but most of the iron taken in is eliminated with the fæces.

The only officinal bitter infusions with which preparations of iron can be prescribed without discoloration, owing to absence of tannin, are Inf. Calumbæ and Inf. Quassia.

### FERRI (PER) ACETATIS TINCTURA.

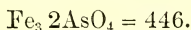
A deep red liquid, transparent at first, but it usually decomposes rapidly and becomes muddy. It was very properly rejected from the Pharmacopœia of 1864. It is stated that a solution four times the strength of the officinal preparation, and made from ferric hydrate and glacial acetic acid is stable, and can be diluted with spirit as required. *Ferrous* acetate can be obtained in white silky crystals.

*Preparation.*—Add an alcoholic solution of acetate of potash to an alcoholic solution of ferric sulphate, and filter from the precipitated sulphate of potash, which is insoluble in spirit.

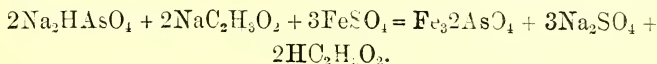


All neutral acetates are soluble, and the deep red colour produced on the addition of a ferric salt, is sometimes used as a test for acetic acid.

### FERRI ARSENIAS.



*Preparation.*—Mix solutions of arseniate and acetate of sodium with ferrous sulphate, filter, and dry at a low temperature (100° F.) in order to avoid oxidation as much as possible:—

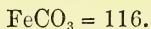


Ferrous arseniate is soluble in *mineral* acids, and, on account of the arseniate of soda not being a neutral salt, acetate of soda is added to prevent the liberation of free sulphuric acid. Ferrous arseniate is insoluble in acetic acid.

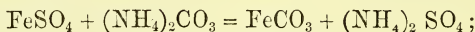
*Characters and Tests.*—White, at the instant of precipitation, it rapidly becomes grey, or greenish-blue, owing to absorption of oxygen, and formation of a mixed arseniate of iron. When thrown on live coals it emits the alliaceous odour of arsenic. Proved to be an arseniate by its filtered alkaline solution, giving, when exactly neutralised by nitric acid, a brick-red precipitate with nitrate of silver. Absence of sulphate shown by its giving no precipitate with chloride of barium. The volumetric test indicates 2·85 grs. of iron in the ferrous state in twenty grains of the arseniate, = 14·25%.

*In Medicine.*—An active preparation, essentially an arsenical remedy, as the quantity of iron in any admissible dose is perfectly insignificant. Half a grain, the maximum dose designated, would contain 0·07 gr. Fe.

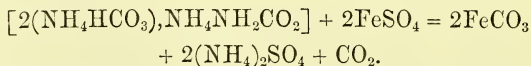
### FERRI CARBONAS SACCHARATA.



*Preparation.*—Add carbonate of ammonium to ferrous sulphate, each dissolved in boiling water, so as to avoid the presence of air.



or, more correctly,



Collect the precipitated ferrous carbonate, wash, and rub it with sugar in a mortar.

*Characters and Tests.*—The precipitate is white when first thrown down, but quickly becomes green (oxy-carbonate), and

finally red from absorption of oxygen, and formation of ferric oxide. There is no carbonate of the peroxide of iron. This preparation is very unstable, and prone to oxidation, and the use of the incorporated sugar is to preserve it as far as possible from oxidation, as originally suggested by Becker, and carried out by Klauer. Absence of sulphate shown by chloride of barium. It is stated that the ferrous carbonate should form at least 37% of the mixture; but the proportion of carbonate varies greatly in commercial specimens. What is often sold as "carbonate of iron" is a brown ferric oxy-hydrate, containing a mere trace of ferrous carbonate.

*In Medicine.*—A mild and excellent non-astringent chalybeate, very readily dissolved in the stomach, and best given in pill, mixed with confection of roses (Pil. Ferri Carb.), or, in the form of Griffith's mixture, Mist. Ferri Co., which is prepared by a process similar to that for the saccharated carbonate, and contains about one gr. of  $\text{FeCO}_3$  in  $\text{ʒi}$ . Griffith's mixture is frequently used in chlorosis, amenorrhœa, and phthisis.

### FERRI ET AMMONIÆ CITRAS.

The first of the "scale" preparations; occurs in transparent ruby-red scales.

*Preparation.*—Dissolve freshly precipitated washed peroxide of iron (prepared by adding persulphate of iron to ammonia) in citric acid, add ammonia, and evaporate to dryness at a moderate temperature, in order to avoid decomposition.

*Characters and Tests.*—It has but a feeble chalybeate taste, and although purely a ferric salt, it is almost insoluble in alcohol, except when very dilute, e. g. Orange wine in the Vinum Ferri Citratis.

Distinguished from the potassio-tartrate of iron (Ferrum Tartaratum), (a) by the alkaline solution from which the iron has separated not giving, when acidulated, a crystalline precipitate of

cream of tartar,  $\text{KHT}$ ; and (b) by the oxide left on incineration not being alkaline to red litmus. Alkaline carbonates do not readily decompose it, and it may therefore be given in effervescence with bicarbonate of potash and citric acid, an advantage which the simple citrate of iron formerly used does not possess.

*In Medicine.*—A mild unirritating chalybeate, introduced into practice by Béral. If prescribed in effervescence care must be taken to put the iron salt into the acid solution, and not into the alkaline solution, because, in the latter case, carbonic acid gas will be given off, and the bottle may be burst. Tinct. Aurantii Recentis is the best flavouring agent, in small quantities; but the salt will not dissolve in undiluted Tinct. Aurantii, as is sometimes prescribed.

### FERRI ET QUINIÆ CITRAS.

Greenish-yellow scales becoming darker by age.

*Preparation.*—Dissolve freshly precipitated peroxide of iron (obtained as above), and quinia (obtained by adding ammonia to a solution of sulphate of quinia in very dilute sulphuric acid), in solution of citric acid, add ammonia, and evaporate to dryness at a moderate temperature. The product is a triple citrate of iron, quinia, and ammonium, and the iron exists in both the ferrous and ferric state, some of the peroxide being reduced to ferrous oxide.

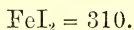
*Characters and Tests.*—It should contain 20% of  $\text{Fe}_2\text{O}_3$ , and 16% of quinia, to which it owes its bitter taste that distinguishes it from the other scale-preparations of iron, but the proportion of quinia varies much in commercial specimens, and sometimes falls as low as 4%. It spoils by long exposure to light, and becomes difficultly soluble. Soda precipitates its solution reddish-brown ( $\text{Fe}_2\text{O}_3$ ), and ammonia, white (quinia). If the alkaloidal precipitate contained any cinchonia it would

not be entirely soluble in ether, which readily takes up quinia, but not cinchonia. The fact that the residue of ferric oxide left after combustion is not alkaline to test-paper shows that no fixed base, e. g. magnesia, has been substituted for quinia in its preparation.

*In Medicine.*—An agreeable tonic, also introduced by Béral, combining the virtues of iron and cinchona, and well suited to cases of anæmia, especially when accompanied by enlarged spleen.

Various other double salts have been proposed, such as the citrates of iron and magnesium, iron and strychnia, iron and zinc; but there is no useful object gained by multiplying such formulæ.

### FERRI IODIDUM.



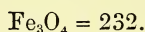
*Preparation.*—Heat iron wire with twice its weight of iodine, and eight times its weight of water, until all the iodine is taken up, as shown by the solution losing its reddish colour, and becoming colourless. Filter, and evaporate in an iron vessel until it is ready to solidify.

*Characters and Tests.*—A very unstable substance, excessively prone to absorb oxygen, and perfectly useless in aqueous solution from this cause. Impaired ferrous iodide may, however, be restored by warming its solution in water with a little more iodine and iron. In the pill and syrup, sugar is used as a preservative against change by hindering oxidation. The iodide is also decomposed by heat, emitting violet coloured vapours of iodine, and it is incompatible with alkalies and their carbonates. The iodine in this salt can be detected by starch mucilage after liberation by means of chlorine.

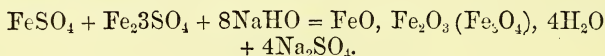
*In Medicine.*—Introduced into practice about fifty years ago by Dr. Thompson, and Dr. Pierquin. Principally used as a

tonic and alterative in scrofulous complaints, chlorosis, obstinate syphilis, &c. It is best prescribed in the Syr. Ferri Iod., which contains nearly  $4\frac{1}{2}$  grs.  $\text{FeI}_2$  in 3i. Soon after ingestion both iodine and iron can be detected in the urine. Ferric iodate has been proposed as a more stable substitute. (Cameron.)

## FERRI OXIDUM MAGNETICUM.



*Preparation.*—This black oxide being a combination of ferrous with ferric oxide, it is prepared by adding a mixed solution of proto- and per-sulphate of iron to an excess of soda,



The precipitate is washed until free from the sodic sulphate as shown by the chloride of barium test, and the oxide is dried at a low temperature,  $130^\circ$ , because it absorbs oxygen readily at higher temperatures, and forms ferric oxide.

*Characters and Tests.*—This oxide is so susceptible to magnetism that even the moist precipitate will collect round a magnet dipped in the supernatant fluid. It should be soluble in hydrochloric acid *without* effervescence; if any particles of metallic iron were present, bubbles of hydrogen would necessarily be given off. Heated in a close vessel it parts with its water of hydration, 20%, and when heated in the open air it is converted into ferric oxide. The volumetric test indicates 24.6% of ferrous oxide,  $\text{FeO}$ .

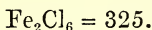
*Forge-scales*, formerly officinal, were a variable mixture of both ferrous and ferric oxide with a little metallic iron.

*In Medicine.*—It has the advantage of being tasteless, like Ferrum Redactum, which has generally superseded it in practice.

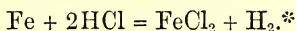


## FERRI PERCHLORIDI LIQUOR FORTIOR.

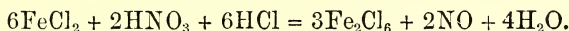
## FERRI PERCHLORIDI LIQUOR.



*Preparation.*—(a). Ferrous chloride is obtained by solution of iron wire in *excess* of hydrochloric acid.



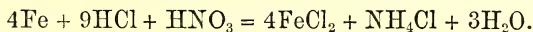
(b) The ferrous is converted into ferric chloride by the addition of a little nitric acid:—



Ferric chloride could not possibly be formed by the direct action of hydrochloric acid on iron, because the nascent hydrogen, which is necessarily set free, reduces ferric salts to the ferrous state.

The liquid is at first black owing to a combination of the colourless gas, nitric oxide, NO, with a portion of the ferrous salt (see Ac. Nitr.), but on heating the mixture, all the gas is expelled, and is converted by the oxygen of the air into red fumes of NO<sub>2</sub>.

The iron wire is not dissolved directly in the mixed acids, an apparently simpler procedure, because in that case not only would ferrous chloride be produced, but also some sal-ammoniac, NH<sub>4</sub>Cl, would be formed, and so contaminate the iron solution:—



The solution usually contains free hydrochloric acid.

*Characters and Tests.*—In aqueous solution it is purely a

\* Crystals of hydrated ferrous chloride, FeCl<sub>2</sub>.4H<sub>2</sub>O, could be procured by evaporating this solution.

persalt of iron, but, when mixed with spirit (e. g. Tinct. Ferri Perchlor.), it is partially reduced to ferrous chloride. When boiled, some hydrochloric acid is evolved, and a darker coloured solution of oxychloride of iron remains. If evaporated to dryness, yellow or red deliquescent crystals of hydrated ferric chloride are obtained. When carelessly prepared it is apt sometimes to contain nitrate of iron. 3i. should contain 31·7 grs. of  $\text{Fe}_2\text{Cl}_6$ .

With mucilage of gum arabic, solution of ferric chloride gives a brown, firm, translucent jelly.

*In Pharmacy.*—Diluted with three volumes of water, it forms the Liq. Ferri Perchlor., or, with three volumes of rectified spirit, the Tinct. Ferri Perchlor., but, for the reason stated, the aqueous solution, which is of the same strength, is to be preferred, and the tincture should be discarded as superfluous and expensive. Moreover, chlorinated ethereal bodies are gradually formed in the tincture by the mutual reaction of the hydrochloric acid and spirit.

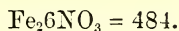
*In Medicine.*—A powerful astringent, causing instant coagulation of the blood. The concentrated solution, or the solid chloride, is caustic, and is sometimes used for the destruction of venereal warts. It is much used for arresting hemorrhage from leech-bites, cuts or wounds. Two or three drops are injected into nævi and vascular tumours, and this procedure has been also recommended in ordinary aneurisms.

Internally, in the diluted form, it is in frequent use as a tonic and astringent, in diarrhœa and other morbid fluxes, e. g. gleet and leucorrhœa.

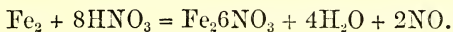
It is frequently prescribed in internal hemorrhage from the uterus, kidneys, or bladder, and is considered to be specially directed to mucous membranes, and to the urinary organs. As a blood-tonic and antiseptic, it is largely used in erysipelas, scarlatina, rheumatism, pyæmia, and diphtheria. The diluted liquor affords an useful injection in the treatment of thread-

worms. In rare cases, the perchloride has, in medicinal doses appeared to cause tetanic spasms.

## FERRI PERNITRATIS LIQUOR.



*Preparation.*—Dissolve iron wire in nitric acid, diluted so as to moderate the action—



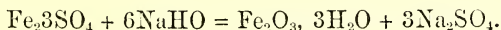
In this case, as well as in the last, the solution is filtered so as to get rid of the carbon or other impurities in the iron which are insoluble in acid.

*Characters and Tests.*—A purely ferric salt. Proved to be a nitrate by colouring a solution of sulphate of iron dark brown after the addition of sulphuric acid. It contains 7·8 grs.  $\text{Fe}_26\text{NO}_3$  in 5i.

*In Medicine.*—Introduced by Mr. Kerr, in 1832. A useful astringent in chronic diarrhœa, particularly when of a mucous character, also in menorrhagia and leucorrhœa, and other morbid fluxes.

## FERRI PEROXIDUM HUMIDUM.

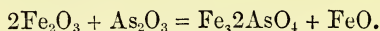
*Preparation.*—Pour solution of persulphate of iron *into* excess of soda, and free the precipitate from sulphate of sodium by washing—



Potash or ammonia may be substituted for the soda. If, conversely, the alkaline liquid were poured into the ferric solution, an oxysulphate would be precipitated.

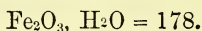
*Characters and Tests.*—The only chalybeate preparation used in the moist state. It contains both combined and uncombined water.

*In Medicine.*—Intended solely as an antidote (Bunsen and Berthold) to arsenic. It must be given very freely, and is of little use except immediately after the poison is taken. Arsenious acid is converted by it into an insoluble ferrous arseniate:—

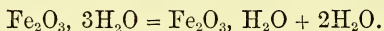


*Dried ferric hydrate* has no action on arsenic, and the moist oxide, even if kept under water, gradually loses its antidotal powers, because it parts with its water of combination.

### FERRI PEROXIDUM HYDRATUM.



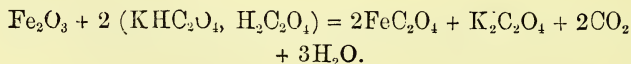
*Preparation.*—Collect and dry at  $212^\circ$  the moist precipitate obtained as above, and powder finely.



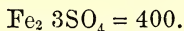
*Characters and Tests.*—Distinguished from the black oxide by its colour, and by being non-magnetic. When heated to redness, anhydrous sesquioxide of iron is left, the *colcothar*, or *mineral rouge*, of commerce.

*In Pharmacy.*—Used in the preparation of Ferrum Redactum, and in making Empl. Ferri, which acts simply as a mechanical support.

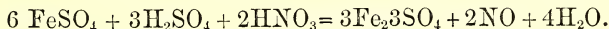
Iron-moulds, which consist of ferric oxide, as also the brown stains ( $\text{MnO}_2$ ) from Condyl's fluid, may be removed by oxalic acid, or *sal acetos* (super-oxalate of potassium), especially the latter:—



## FERRI PERSULPHATIS LIQUOR.



*Preparation.*—Ferrous sulphate is converted into ferric sulphate by the aid of nitric acid and some additional sulphuric acid—



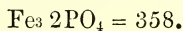
The nitric oxide gas is at first absorbed by part of the unaltered ferrous salt forming a black solution ( $= 2\text{FeSO}_4 + \text{NO}$ ), but, on boiling, the NO is set free, and forms ruddy fumes of  $\text{NO}_2$  as it meets with the air.

*Characters and Tests.*—A purely ferric salt, with a sour and very astringent taste; known to be a sulphate by giving a white precipitate with chloride of barium. The solution contains 28·6 grs. of  $\text{Fe}_2 3\text{SO}_4$  in 3i.

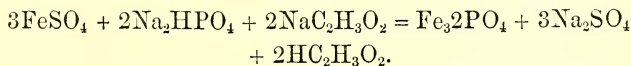
*In Pharmacy.*—Used in making other preparations of iron, especially those in which the recently precipitated peroxide is required, e. g. the double citrates.

*In Medicine.*—A powerful styptic, occasionally employed as an injection into nævi, but not used internally.

## FERRI PHOSPHAS.



*Preparation.*—The process is quite analogous to that for the arseniate of iron. Precipitate sulphate of iron with phosphate of sodium, adding acetate of sodium to prevent the liberation of free sulphuric acid, which would dissolve the precipitated ferrous phosphate. Acetic acid does not dissolve it—



The precipitate is dried at a low temperature,  $120^\circ$ , to avoid oxidation as much as possible.

The process for making Syr. Ferri Phosph. is identical, except that an excess of free phosphoric acid is introduced which dissolves the ferrous phosphate.

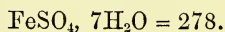
*Characters and Tests.*—Always contains some peroxide. Proved to be a phosphate by giving a white precipitate (triple phosphate,  $\text{MgNH}_4\text{PO}_4, 6\text{H}_2\text{O}$ ), when ammonio-sulphate of magnesium is added to its solution in hydrochloric acid mixed with tartaric acid and excess of ammonia. The solution must be rendered alkaline, else the precipitate of triple phosphate could not be formed, and the tartaric acid prevents the precipitation of oxide of iron by the ammonia. Distinguished from the arseniate of iron by *not* producing a dark deposit of arsenicum on a slip of pure copper introduced into its hydrochloric acid solution (Reinsch's test), and by not emitting an alliaceous odour when thrown on a live coal. The volumetric test indicates 4.2 grs. Fe, or 44.75% of ferrous phosphate.

*In Pharmacy.*—The Syr. Ferri Phosph. contains one gr. of ferrous phosphate in  $\text{ʒi}$ .

*In Medicine.*—Recommended especially in amenorrhœa and some forms of dyspepsia, in cases of scrofulous and rachitic anæmia, and in nervous exhaustion, on theoretical grounds.

*Parrish's Chemical Food.*—Is a compound syrup of the phosphates of iron, lime, potash, and soda, containing free phosphoric and hydrochloric acids. Other phosphatic chalybeate syrups are also in use, viz. :—Syr. Ferri Phosph.  $\bar{e}$ . Quinia et Strychn. (Easton); Syr. Ferri Phosph.  $\bar{c}$ . Manganes., and the Syr. Ferri Hypophosphitis is preferred by some. Ferric phosphate  $\text{Fe}_2\text{P}_2\text{O}_7$ , is not now used in medicine.

## FERRI SULPHAS.



Three forms of ferrous sulphate are officinal, viz :—(a.) large green crystals, i. e. green vitriol, Ferri Sulphas; (b.) a



yellowish-grey amorphous powder, Ferri Sulph. Exsiccata; (c.) minute green crystals, Ferri Sulph. Granulata.

*Preparation of (a).*—Dissolve iron wire in *dilute* sulphuric acid:— $\text{Fe} + \text{H}_2\text{SO}_4 = \text{FeSO}_4 + \text{H}_2$ .

Whenever cold dilute sulphuric acid acts upon metals, hydrogen is liberated, but when the hot and strong acid is requisite, as with copper and mercury, sulphurous acid gas is disengaged. The same metal, e. g. Fe, or Zn, will develop H or  $\text{SO}_2$  gas according as the acid is diluted or not.

*Characters and Tests.*—When of a rich green colour it is not pure, but contains some ferric oxide. Exposed to the air, especially when moist or in solution, it absorbs oxygen and gradually turns brown from formation of ferric sulphate, while, at the same time, it deposits a rusty coloured sediment of basic sulphate ( $\text{Fe}_4\text{O}_5, \text{SO}_4$ ).

If nearly free from ferric salt—a rare occurrence—it gives an almost white precipitate with yellow prussiate of potassium, thus,  $\text{K}_4\text{FeCy}_6 + \text{FeSO}_4 = \text{K}_2\text{SO}_4 + (\text{K}_2\text{Fe}, \text{FeCy}_6)$ .

The crystals effloresce slightly in dry air; at  $238^\circ$  they lose  $6\text{H}_2\text{O}$ , and at a red heat, the sulphuric acid is driven off, and the red peroxide (colcothar) is left.

It is proved to be a sulphate by giving a white precipitate with chloride of barium; the absence of copper is shown by no precipitate being formed with sulphuretted hydrogen; and of ferric salt, by the insolubility of the ferrous salt in spirit.

The best test for copper consists in the deposition of a red film of copper on a clean bit of iron immersed in the acid solution.

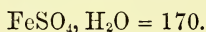
*In Pharmacy.*—From this salt the *insoluble* compounds of iron are prepared by double decomposition, e. g. Ferri Carb. Sacch.

*In Medicine.*—A favourite astringent and tonic, but apt in large doses to induce gastric disturbance and purging.

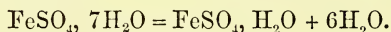
Chiefly used in checking immoderate discharges, e. g. passive hemorrhage, profuse sweats, chronic mucous catarrh, &c. A

good tonic-aperient mixture is afforded by such a formula as sulphate of iron, two grs., sulphate of magnesium,  $\text{ʒi.}$ , sulphate of quinia, one gr., dilute sulphuric acid, m.  $\text{iiij.}$ , spirit of chloroform, twenty m., and peppermint water, to  $\text{ʒi.}$  Externally, as a lotion or injection in chronic ophthalmia, gleet (one to two grs. to  $\text{ʒi.}$ ), and erysipelas ( $\text{ʒiiij.}$  to a pint, Velpeau).

### FERRI SULPHAS EXSICCATA.



*Preparation.*—Heat crystallised sulphate of iron to  $400^\circ$ .



The last molecule of water is only expelled by a much stronger heat, but is easily replaced by other sulphates, double salts being formed, e. g.  $\text{FeSO}_4, \text{K}_2\text{SO}_4, 6\text{H}_2\text{O}$ .

*In Pharmacy.*—Preferred to the crystals of green vitriol for making pills, because it does not alter on exposure, and is not gritty. Three grs. are equal to five grs. of the crystallised salt, and when mixed with two grs. of manna, make a nice pill. (Squire).

### FERRI SULPHAS GRANULATA.

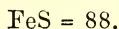
*Preparation.*—Filter a boiling solution of sulphate of iron, prepared as above (see p. 328), into cold rectified spirit, kept constantly stirred. Pure ferrous sulphate, being insoluble in spirit, is precipitated, any ferric sulphate possibly formed is held in solution.

*Characters and Tests.*—Identical in chemical composition and medical properties with ordinary green vitriol, but it is much more stable, and when carefully dried undergoes no change by keeping, even after many years.

*In Pharmacy.*—Used in making the Syr. Ferri Phosph., and

the solution of sulphate of iron (App. II.) employed in testing nitric acid.

### FERRI SULPHIDUM. (App. I.)



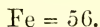
*Preparation.*—Press a stick of sulphur against a white hot bar of cast iron, and allow the melted ferrous sulphide as it is formed to drop into a vessel of water.

*Characters.*—Occurs in brownish yellow globules or tears of a somewhat crystalline texture. It is insoluble in water, but soluble in dilute acids.

*In Pharmacy.*—Employed solely as an agent for the preparation of sulphuretted hydrogen gas. (App. I.)



### FERRUM.



Iron wire (No. 35, i. e. 0.005 inch) or nails.

Three forms of metallic iron occur in commerce :—(a) *Pig or cast iron*, the impure metal as it issues from the furnace, containing a large amount of carbon and other impurities (silicon, phosphorus, sulphur). Cast iron when purified by fusion and oxidation constitutes (b) *wrought or malleable iron*, the officinal form, and this, when combined with a minute proportion of carbon, yields (c) *steel*, a modification formerly employed in medicine, but now disused.

Iron wire is specially directed for use because it can be made only from the purest and most ductile iron, and is readily cut into pieces. Iron filings are generally very impure and dirty.

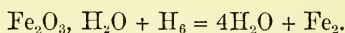
*In Pharmacy.*—The preparations made by direct solution of iron wire in the proper solvents are the iodide, sulphate,

perchloride, perntrate, aromatic mixture, and wine of iron. (See p. 314.)

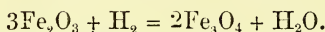
*In Medicine.*—Metallic iron is used medicinally in the form of the next preparation. Iron wire sutures are employed in surgical operations.

### FERRUM REDACTUM.

*Preparation.*—Reduce hydrated peroxide of iron by a stream of dry hydrogen gas at a red heat:—



At the same time, by incomplete reduction, some magnetic oxide is formed:—



The hot metal, which is in a minute state of division, is very prone to oxidation, and if exposed to the air in that state will take fire, and burn into oxide, i. e. it is a pyrophorus. Hence the stream of hydrogen must be kept up while the metal is cooling, so as to avoid oxidation as much as possible.

The temperature during the process should not be too high, else the reduced iron will be agglutinated into small masses.

*Characters and Tests.*—It never consists entirely of metallic iron, as was shown above. The oxide can be separated from the metal, and its amount ascertained by digesting the powder in a solution of iodine in iodide of potassium, which dissolves the metallic iron alone. At least 50% of the metal should be present, and its existence is shown by the evolution of hydrogen gas, when it is dissolved in hydrochloric acid. A little sulphide of iron is sometimes present, and this proves disagreeable by causing eructations of sulphuretted hydrogen.

*In Pharmacy.*—In the form of lozenges (Trochisci Ferri Redacti, one grain in each) the gum and sugar protect the iron from oxidation.

*In Medicine.*—A convenient and tasteless form of administering iron, introduced by Quevenne and Miquelard, and sometimes called Quevenne's iron.

It is readily soluble in the gastric juice, and offers a convenient means of giving iron to children. Iron filings have been recommended in poisoning by salts of copper and mercury; the more oxidisable metal, Fe, displaces and precipitates the Cu or Hg from their combinations, and so forms comparatively inert compounds.

### MISTURA FERRI AROMATICA.

#### *FERRUM TANNICUM.*

Tannate of iron is a black inky precipitate, and is the basis of this mixture.

*Preparation.*—Iron wire is digested in an infusion of several vegetable substances, all of which, except calumba, contain tannic acid. Since tannate of iron is slowly formed, the mixture is black, and is sometimes called *Heberden's ink* from the celebrated physician who introduced it. It contains only about one gr. of iron in a pint.

*In Medicine.*—A suitable carminative tonic in cases where it is desirable to introduce a small quantity of iron gradually into the system. This preparation, as well as Griffith's mixture, is an illustration how substances chemically incompatible may nevertheless be physiologically active. It is simply necessary that the precipitate should be soluble in the gastric fluid, and so gain access to the circulation.

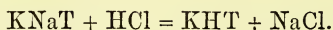
#### FERRUM TARTARATUM.

Deep red scales or glistening fragments.

*Preparation.*—Dissolve freshly precipitated peroxide of iron in solution of acid tartrate of potash (cream of tartar): let it stand

for twenty-four hours, as the reaction is slow, and evaporate *cautiously* to dryness, so as to avoid decomposition.

*Characters and Tests.*—One of the “scale preparations,” and although a persalt, sparingly soluble in spirit. Boiled with soda (or potash) it deposits the insoluble base, peroxide of iron, but evolves no ammonia, whereby it is distinguished from the Ferri et Ammoniæ Citras. The filtered solution, which will then contain tartrate of potassium and sodium (Rochelle salt), gives, when acidulated with any acid, a crystalline precipitate of acid tartrate of potassium:—



On incineration the salt should yield 30% of ferric oxide.

*In Medicine.*—An agreeable chalybeate, readily soluble, easily tolerated, and scarcely astringent. It is given in simple aqueous solution. The Vinum Ferri is essentially a dilute alcoholic solution of potassio-tartrate of iron, formed by the action of the cream of tartar in the wine upon the iron.

## FICUS.

*Origin.*—The common fig-tree, *Ficus Carica*, N. O. Urticacæ, is now very common throughout the whole basin of the Mediterranean. The so-called fruit really consists of the fleshy, pyriform, hollow receptacle, bearing the numerous minute unisexual flowers, and afterwards the true fruits, on its inner surface. Such a product as the fig is in botany termed a *syconus*, and is in fact the matured result of a whole inflorescence, and not of a single flower. The fig, like cassia pulp, contains a large proportion, 62%, of cane sugar (sucrose), and inverted sugar.

*In Pharmacy.*—Figs form a very unnecessary ingredient in the complex Conf. Sennæ.

*In Medicine.*—Ripe figs are mildly laxative, but, if eaten freely, are apt to cause griping. They are occasionally used as



a poultice, and a roasted fig is a popular application to a gum-boil to promote suppuration.

## FILIX MAS.

*Origin.*—Commonly called fern-root, but, strictly speaking, it is the rhizome or root-like underground stem of *Aspidium Filix Mas*, N. O. Filices, an indigenous plant, and one which abounds in all parts of Europe. The epithet “male” simply refers to the greater robustness of this plant as contrasted with the more delicate and beautiful “female” or “lady” fern, and does not point to any sexual peculiarity.

*Characters.*—A long cylindrical root stock, upon which are closely arranged in an imbricate manner, the remains of the leaf stalks, surrounded at their base by their shining brown scales. The most important constituent of fern is a greenish fixed oil, which is taken out by ether (*Extr. Filicis Liq.*). This is associated with volatile oil, resin, colouring matter, and filicic acid,  $C_{14}H_{18}O_5$ . A cooled decoction is rendered blue by tinct. iodi, and black by the salts of iron.

*In Medicine.*—An active and efficient anthelmintic, especially against tape-worm, and probably the most certain means we have of poisoning and expelling these parasitic animals. It constituted the basis of Madame Nouffer’s specific for tape-worm, for which Louis XV. paid over £700.\* 3ss. of the extract (oil of male fern) with a little mucilage, milk, or syrup, in some aromatic water, may be given at night, and followed in the morning by a dose of castor oil.

\* “*Filix Mas radicem habet maximè utilem; latum enim lumbricum interficit, si quis eam quatuor drachmarum pondere in aqua mulsa sumpserit.*”  
—*Dioscorides a Matthiolo*, folio, Venet, 1565, p. 1291.

## FÆNICULI FRUCTUS.

*Origin.*—The sweet fennel and the common fennel are closely allied plants, and belong to the genus *Fœniculum*,\* N. O. Umbelliferae.

*Characters.*—The fruits, improperly called seeds, are distinguished by their length, prominent ribs, and odour. The chief ingredient is about 2% of a volatile oil upon which the odour and taste depend. Although differing in odour, the oil nearly corresponds in proximate composition to oil of anise.

*In Medicine.*—Fennel is a powerful aromatic and carminative, occasionally used to correct the nauseous properties of senna and rhubarb, and as a remedy in the flatulent colic of children.

It is stated to have the power of increasing the flow of milk.

## GALBANUM.†

*Origin.*—Botanists have not as yet been able to determine with certainty the plant which yields this fetid gum resin, except that it belongs to the N. O. Umbelliferae. It has recently been ascribed to *Ferula erubescens*.

*Characters.*—Occurs in irregular masses, generally mixed with portions of stalk, seeds, and other impurities. With water it forms an imperfect milky emulsion, and proof spirit dissolves the greater part of it. It contains from 20 to 25% of gum, about 65% of resin,  $C_{40}H_{54}O_7$ , and 3 or 4% of volatile oil, isomeric with oil of turpentine.

The resin when heated yields an oil of a fine indigo blue colour.

*In Medicine.*—It possesses qualities similar to those of ammoniac and assafoetida, but is seldom or ever employed, except as a plaster, and is a useless encumbrance to the Pharmacopœia.

\* Dimin. *Fœnum*, hay; from the capillary segments of its leaf.

† A Hebrew term.

## GALLA.

*Origin.*—Numerous plants, besides the oak, when pierced by certain insects, give rise to morbid growths partaking of the nature of the plant from which they spring. These structures are called galls, and from their mode of origin, may be looked on as vegeto-animal products.

The *dyer's oak*, *Quercus infectoria*, N. O. Cupuliferæ, is admitted to be the source of the best galls, which originate from the irritation set up by the punctures of a small fly on the shoots and young buds. The female insect deposits an egg in the wound, and the bud thus irritated speedily develops itself in a peculiar manner, and forms a spheroidal body which retains nothing of its original form except the asperities due to the projections of the bud scales. The galls of commerce are collected in Syria and Asia Minor.

*Characters.*—Galls are in perfection when fully developed, before the insect has eaten its way out, and they should not exhibit a foramen on the surface. Inferior galls are lighter coloured, and less heavy and compact. Galls possess a bitter, astringent taste, and contain from 25 to 65% of tannin, besides gallic and other acids. English galls are smooth on the surface, and contain from 14 to 28% of tannin. Guibourt has made the curious observation that starch exists in galls exclusively in the shell which immediately surrounds the central cavity in which the insect dwells, and further that hard compact galls frequently include small air-cells or cavities, chiefly round the spherical starchy mass. Thus the young insect is furnished with the means of sustenance and of respiration.

All the soluble matter of galls is taken up by forty times their weight of boiling water, and the residue is tasteless. The infusion or tincture is precipitated by numerous reagents,

especially by salts of the heavy metals, by gelatin, albumen, the vegetable alkaloids, &c.

*In Pharmacy.*—Tannic acid is directly prepared from galls, and gallic acid by slow metamorphosis from the tannin. Tincture of galls is a common reagent for detecting iron, gelatin, and alkaloids.

*In Medicine.*—Seldom used internally, for we have other less bulky and nauseous astringents at command. Since we know that the tannates of antimony and of the alkaloids are not so insoluble and inert as was supposed, the value of galls or tannin as antidotes to these poisons is questionable.

Locally, the gall and opium ointment is frequently applied to external piles.

### GENTIANÆ RADIX.

*Origin.*—The yellow gentian, *Gentiana*\* *lutea*, N. O. *Gentianaceæ* is one of the largest and handsomest species of the genus, bearing clusters of showy yellow flowers in the axils of the upper leaves. It grows in the elevated regions of Europe, and the root is the only part used in medicine.

*Characters.*—Easily distinguished from other roots by its twisted, wrinkled, or ringed appearance on the outside, its yellow and spongy interior, and its bitter taste. The whole order of *Gentianaceæ* is remarkable for the decided bitterness of its members.

Gentian is free from tannic acid, and hence does not blacken salts of iron. It contains sufficient sugar to undergo vinous fermentation when macerated in water, and the Tyrolese peasants prepare from it a sort of brandy. No alkaloid has as yet been isolated from it, and its chief constituents are a crystalline

\* Gentius, a king of Illyria, 172, B. C., who was the first to make known the virtues of this plant.

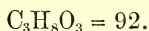
and tasteless acid, the *gentianic*, and a crystalline bitter substance, *gentio-picrin*,  $C_{20}H_{30}O_{12}$ .

*In Pharmacy.*—Although gentian itself is compatible with iron salts, the compound infusion, mixture, and tincture of gentian, will blacken iron compounds owing to the tannin in the bitter orange peel, &c., which occur in these preparations. The extract is often used as a vehicle for pill masses.

*In Medicine.*—A simple, bitter tonic, in use for many ages, and much appreciated to the present time. It is applicable in all cases such as convalescence from acute disease, or simple dyspepsia, and generally proves acceptable to the stomach, and, moreover, does not tend to constipate. It is usually administered in the form of infusion or tincture. The bitter principle is said to be eliminated in the urine and sweat.

Dried gentian root is sometimes used as a tent.

## GLYCERINUM.\*



*Origin and Preparation.*—Glycerin was discovered by Scheele, in 1789, and may properly be termed a vegeto-animal product, for it can be obtained from any ordinary fat, or *fixed* oil, whether animal (lard) or vegetable (olive oil). It was formerly (*a*) prepared in large quantities in the manufacture of lead plaster (see Empl. Plumbi), and is (*b*) set free in the process of soap making, but the finest glycerin (Price's) is now (*c*) prepared from palm oil by Tilghman's method. Steam, at a temperature of  $500^{\circ}$  to  $600^{\circ}$ , is passed through a distillatory apparatus containing palm oil or other fat. The oil is decomposed into its fatty acids and glycerin, which distil over with the water, and are condensed in the receiver.

\* Γλυκὺς, sweet. German, *oelzucker*, i. e. the "sugar of fats."

The distillate separates into two layers, and the fatty acids float upon the aqueous solution of glycerin. This process may be designated as aqueous saponification, for the principle of saponification is the splitting up of a fat into its acid and glycerin. Almost all fats and oils (except spermaceti and wax) consist of one or more of three fatty acids—palmitic, stearic, or oleic—in combination with glycerin, forming palmitin, stearin, and olein, and may thus be regarded as analogous to ordinary inorganic salts. Thus, as nitre is nitrate of potassium, so olive oil (olein) is oleate of glycerin. Stearin, palmitin, and olein are identical with the natural fats; they can be obtained artificially, and are, in fact, nothing but the *compound ethers* of glycerin. Hence glycerin, acting the part of a base in fats, can be liberated from them by adding a stronger base, such as potash or soda, as is seen in the manufacture of soap. (On the general relations of fats and oils, see Olea.)

*Characters.*—In its superficial characters, glycerin stands, as it were, intermediate between water and oils, and when exposed to the air, it does not sensibly evaporate, but gradually absorbs moisture.

When of the density 1.25, it contains about 96% of anhydrous glycerin. The sp. gr. of pure glycerin is 1.28. It is usually stated to be not crystallisable, nor can it be frozen at a temperature of  $-35^{\circ}$  C. ( $-31^{\circ}$  F.), but Sarg exhibited at the Vienna Exhibition specimens of pure crystallised glycerin. It is miscible in all proportions with water, alkalies, alcohol, and ether diluted with alcohol, but it is insoluble in pure ether and chloroform.

As a solvent it possesses very extensive powers, having a range somewhat corresponding to—but more considerable even than—proof spirit. It is remarkable for its power of dissolving so many and such varied substances, animal, vegetable, and mineral. It dissolves more or less readily most bodies which are soluble in water, and is a better solvent than water for bromine, iodine, and carbolic acid. Some bodies are decomposed



by it, e. g. bichromate and permanganate of potassium. Yet it does not mingle with fatty oils, and dissolves essential oils only to a limited extent, as also gums, resins, and balsams. Glycerin does not become rancid on exposure, does not ferment spontaneously, and it cannot be distilled without decomposition, except in the presence of steam, or in a partial vacuum.

If decomposed by heat it evolves intensely irritating vapours of acrolein (allylic aldehyd),  $C_3H_5O_3 - 2H_2O = C_3H_4O$ . At a full red heat it takes fire, and burns with a blue flame. It possesses antiseptic properties, and is much used in the preservation of microscopical objects, hypodermic solutions, vaccine virus, and of anatomical and pathological specimens. Acted on by strong nitric acid it yields nitro-glycerin or glonoin,\* a bright yellow, explosive, volatile, and poisonous oily liquid,  $C_3H_5(NO_2)_3O_3$ , which, if given in minute doses,  $\frac{1}{40}$  of a drop internally, has caused very serious symptoms, but nevertheless has been proposed for medicinal use in neuralgia and spasmodic affections.

*Chemical Constitution.*—Although vaguely defined in the Pharmacopœia as a “sweet principle” it is almost needless to say that it has no immediate chemical connexion with the sugars. In its chemical relations and analogies, glycerin is strictly an alcohol, and, since it has three atoms of replaceable hydrogen, it is a triatomic alcohol containing the triad radical *glyceryl*, thus  $\left. \begin{matrix} \dagger C_3H_5''' \\ H_3 \end{matrix} \right\} O_3$ , and so may be termed glyceric alcohol. Fats and fixed oils are derived from glycerin by the replacement of these atoms of hydrogen by the same number of molecules of the radicals of the fatty acids, which are all monobasic. Nitro-glycerin is another good example of one of its substitution products.

\* Formed from the initials of *g*lycerin, *o*xxygen, and *n*itrogen.

†  $C_3H_5$  is a saturated hydrocarbide and therefore  $C_3H_5$  could not have a higher atomicity than three.

*Impurities.*—Sometimes diluted with water, which lowers its density and consistence. If it contain 50% of water, its density will be 1.118. Occasionally, as when prepared by alkaline saponification (foreign glycerin), it contains chlorides of calcium and sodium; and sometimes cane and grape sugar, as well as traces of lead and other metals used in its manufacture. A drop rubbed on the hand should develop no unpleasant odour (rancid oils), it should not be discoloured, nor give off gases ( $\text{CO}$  and  $\text{CO}_2$ ) when heated with strong sulphuric acid, nor turn brown with caustic potash (glucose). Neither should it become turbid, when mixed with four volumes of alcohol (gum, dextrin, or glue), it should not redden litmus paper (acids) nor reduce ammonio-nitrate of silver (formic acid), nor yield a pineapple odour when gently warmed with a little alcohol and strong sulphuric acid (butyric acid).

*In Pharmacy.*—Much used as a vehicle for other remedies on account of its solvent powers. If added to extracts and pills, it keeps them soft and free from mouldiness. Mixed with collodion it renders it plastic and flexible, and it occurs in the Lin. Pot. Iod.  $\bar{c}$ . Sapone. In prescribing glycerin it is well to remember that it is oxidisable, and will reduce chromic acid, bichromate and permanganate of potassium.

*In Medicine.*—Internally, glycerin has been recommended as a nutrient and demulcent remedy, and as a substitute for cod-liver oil, but at present it is almost exclusively used as an external therapeutic agent. Its emollient virtues and non-drying qualities render it suitable to many cases of skin disease, especially those of a harsh and dry character, and, added to lotions or ointments, it is frequently used with great benefit in pityriasis, lichen, eczema, prurigo, and ichthyosis. But glycerin is not altogether devoid of irritating qualities, and some skins will not tolerate it, even in a very diluted form. As a general rule it should not be used in acute skin diseases attended with marked inflammatory irritation.

Added in small quantity to poultices it keeps them soft for a long time. It is in common use for excoriations of the skin, and is sometimes introduced into the auditory meatus, but, unless diluted, is apt to cause smart pain for a time, especially if not perfectly pure.

### GLYCERINA.

The medicated glycerines, i. e. solutions of other drugs in glycerin, should be distinguished by some special name, such as *glycerates* or *glyceroles*. The glyceroles of gallic, carbolic, and tannic acids, and of borax, contain one in six *by weight* of their respective drugs.

GLYCERINUM ACIDI CARBOLICI.

GLYCERINUM ACIDI GALLICI.

GLYCERINUM ACIDI TANNICI.

GLYCERINUM AMYLI.

GLYCERINUM BORACIS.



For their several uses see Acidum Carbolicum, &c.

### GLYCYRRHIZÆ\* RADIX.

*Origin.*—The Glycyrrhiza glabra, N. O. Leguminosæ, is a native of the south of Europe, and the part used, which is popularly regarded and loosely defined as the root, or underground stem, is a true rhizome, i. e. stem.

*Characters.*—The yellow fibrous interior, and its peculiar and well known sweet mucilaginous taste, sufficiently distinguish liquorice root. Its most important constituent is an uncrystallisable glucoside, glycyrrhizin,  $C_{24}H_{36}O_9$ , of a bitter sweet taste, and which is precipitated from its watery solution by the addition of a dilute acid, acetic or sulphuric. Glycyrrhizin (glycion) has also been found in other leguminous underground stems.

\* Γλυκὺς, sweet, ῥίζα, a root.

*In Pharmacy.*—The yellowish powder is used in the preparation of pills, either as a vehicle for other drugs, e. g. Pil. Hydrarg., or to prevent them from cohering, and it enters into Conf. Terebinthinæ, and the new aperient, Pulv. Glycyrrh. Co. Liquorice has a remarkable power in covering the nauseous taste of acrid substances, such as aloes, sal-ammoniac, and mezereum (Dec. Sarsæ Co.), and for this purpose, the new Extr. Glycyrrh. Liq. is an useful preparation. Extract of liquorice, commonly known as “liquorice ball,” is frequently subject to adulteration, and liquorice powder is often falsified on the Continent with a pigment called *French yellow*.

*In Medicine.*—A popular demulcent, often used in catarrhal affections of the mucous membranes, but devoid of any special properties.

## GOSSYPIUM.

*Origin.*—The number of distinct species in the genus *Gossypium*, N. O. Malvaceæ, has not been satisfactorily made out; but several varieties, at least, are cultivated in tropical countries, especially America and India. *G. herbaceum* is the common cotton plant of India, and *G. barbadense* is said to supply the best cotton.

The three celled fruit opens when ripe, and displays a beautiful white tuft of long, slender filaments—the raw cotton—which consists of the numerous fine tubular hairs which surround the five or six seeds, and adhere firmly to their outer coating.

The hairs flatten and twist on drying, and are intersected by occasional joints. Microscopically, cotton is distinguished from linen by the fibres of the latter being in bundles, round, and tapering at their extremities, which overlap each other.

The seeds yield a large proportion of a bland, fixed, drying oil, used in the arts for various purposes.

It is remarkable that not a single malvaceous plant is poisonous, and most of them contain an emollient mucilage.

*Characters.* — Chemically, cotton is nearly pure cellulose,  $C_6H_{10}O_5$ , isomeric with starch, dextrin, &c., soluble in strong alkaline solutions, decomposed by the concentrated mineral acids, and converted by nitric acid into the remarkable nitro-compound, known as gun-cotton. (See Pyroxylin.) For medical use it should be carded into thin sheets. What is termed cotton wadding, consists of thin sheets somewhat stiffened and glazed upon one surface by starch.

*In Medicine.*—Frequently employed as a soft and convenient padding in the management of fractures, and much used in the treatment of recent burns and scalds, where there is not too free exudation, and to envelope gouty and rheumatic joints. Cotton cloth (calico) is not so well adapted as linen (lint) for surgical dressings, on account of the twisted nature of its fibre. An artificially blistered surface is best dressed, in most cases, by the simple application of cotton wadding in thick layers (Maclagan). It has been shown that air, filtered through cotton, loses the property of inducing putrefaction in organic tissues, and the use of cotton respirators has recently been suggested.

The root of the cotton plant has been credited with emmenagogue qualities, and with an influence on uterine contraction similar to that of ergot.

## GRANATI RADICIS CORTEX.

*Origin.*—The pomegranate, *Punica Granatum*,\* N.O. Myrtaceæ, is a small, shrubby tree, bearing large scarlet flowers

\* Said to have been introduced into Italy by the Romans during the Carthaginian wars. According to Guibourt the name *Punica* is derived from the original *habitat* of the plant about Carthage, and the name *Granatum* from the large number of seeds (grains) in the fruit.

(balaustines), and a red fruit, about the size of an orange. The only part now officinal is the root-bark, but the rind of the fruit was formerly recognised.

*Characters.*—Distinguished by its ash-grey fragmentary quills, whose inner surface, moistened with water and rubbed on paper, produces a yellow stain, rendered blue by ferrous sulphate, and rose colour by nitric acid. It contains tannic and gallic acids, with some mannite. Occasionally adulterated with the root-bark of the box, and the branch-bark of the barberry. Neither of these are astringent, although very bitter, and barberry bark gives no reaction with ferrous sulphate, nor with gelatin.

*In Medicine.*—The vermifuge properties of the root were known to the ancients; but the drug was introduced into modern practice by Dr. F. Buchanan, who learned its value in India, where it had for ages been used as an anthelmintic.

It is efficacious in dislodging the tape-worm, and the decoction may be given freely,  $\bar{3}$ i. to  $\bar{3}$ ij. every two hours. It usually purges, and often causes nausea and vomiting. If necessary, a dose of castor oil may follow.

## GUAIACI\* LIGNUM.

## GUAIACI RESINA.

*Origin.*—The *Guaiacum officinale*, N. O. *Zygophyllaceæ*, is a large tree, with rich blue flowers, a native of the West Indies. It was introduced into European medicine by the Spaniards in the beginning of the sixteenth century, not long after the discovery of the New World.

*Characters.*—(a). *Of the Wood.*—The wood (*lignum vitæ*) is imported in logs or billets, with a dark heart-wood, covered with a thick grey bark, and having on its inner surface numerous shining crystals of sulphate of calcium. It is usually kept

\* Spanish, *Guayaco*.



in the state of shavings or raspings, which are obtained from the turners, by whom it is much used on account of its extraordinary hardness and toughness. It is so heavy (sp. gr. 1.33) that it sinks quickly in water, and it is remarkable for its cross-grained appearance, the fibres intersecting diagonally and obliquely. The powder of the genuine wood, when slightly heated with solution of corrosive sublimate, or treated with nitric acid, is turned blueish green. (*b*). *Of the Resin*.—The resin, which forms about 26% of the wood, is obtained by spontaneous exudation (tears), or by artificial means. It occurs in tears or in masses, resembling a lump of dark green bottle glass, is very brittle, and although olive brown when recent, turns green on exposure to the air. The chief constituents of the resin are *guaia-resinic acid*, 10%,  $C_{20}H_{26}O_4$ ; *guaiaconic acid*, 70%,  $C_{19}H_{20}O_5$ ; and *guaiacic acid*,  $C_6H_8O_3$ , with indifferent resin, and colouring matter. The resin, being mostly acid, combines with alkalies, e. g. Tinct. Guaiaci Ammon., and is capable of undergoing peculiar colour changes by oxidation with different reagents. The simple spirituous tincture is coloured blue by nitric acid, nitrous ether, chromic acid, chlorine, prussic acid with cupric sulphate, gluten and substances containing it, e. g. potato, carrots, horseradish, &c., but not by starch. Also by mucilage of gum arabic, unboiled milk, &c. A dilute solution (one in 1000) of chromic acid is a very delicate test for guaiacum, and v. v. (Schiff.) The officinal ammoniated tincture will not answer for these tests on account of the resinous acids being neutralised by the ammonia. The blue colour appears to result from oxidation of the free acids, and reducing agents restore the original yellowish colour. Like resin of jalap, guaiac resin is insoluble, or nearly so, in oil of turpentine, and is thus distinguished from pine resin. By destructive distillation the resin yields a thick tar, which contains, among other bodies, *guaiacol*,  $C_7H_8O_2$ , and *creasol*,  $C_8H_{10}O_2$ , the two most important ingredients in commercial creasote from wood tar.

*In Pharmacy.*—The resin forms an ingredient, and not a very essential one, in Plummer's pill (Pil. Hydrarg. Subchlor. Co.), and the wood enters in fractional proportion into the Dec. Sarsæ Co. The tincture is incompatible with the mineral acids, blue, brown, or green precipitates being formed.

*In Medicine.*—Three hundred years ago guaiacum attained great celebrity as a remedy in syphilis, and has often been recommended in chronic rheumatism and gout; but its virtues have been overrated, and its value is very questionable beyond that of a mild stimulant and laxative. It is said occasionally to cause salivation, and even a measly eruption.

The tincture may be given in emulsion with milk.

The combination known as "Chelsea pensioner" consists of guaiac resin, cream of tartar, sulphur, rhubarb, ginger, nutmeg, and honey or treacle.

### GUTTA-PERCHA.

*Origin.*—This valuable product, introduced into England in 1843, is the solidified milky juice of a lofty tree, *Isonandra gutta*, N. O. Sapotaceæ, a native of the Malayan Archipelago, and especially of Singapore. It exudes from incisions made in the tree, and is purified by "devilling," i. e. kneading in hot water.

*Characters and Tests.*—Pure gutta-percha is nearly white, and when cold is quite hard, very tenacious and resistant, but in hot water it becomes so soft that it can be moulded to any form. On cooling it resumes its former state, and retains any shape which may have been given to it. It is a bad conductor of heat and electricity, and resists putrefaction strongly, and is extensively employed for covering wires for electrical purposes. Gutta-percha is insoluble in water, alcohol, and alkalies, and, although sulphide of carbon, benzol, and oil of turpentine, take it up, the best solvent is chloroform (Liq. Gutta-percha). Its chief constituent is a hydrocarbon called *gutta*, which seems to be closely allied to, if not identical with,

the fundamental hydrocarbide of india-rubber. By treatment with sulphur gutta-percha may be vulcanised in the same manner as caoutchouc.

*In Pharmacy.*—The Liq. Gutta-percha is the basis of Charta Sinapis.

*In Medicine.*—Besides its numerous and increasing applications in the arts to many useful and ornamental purposes, and its utility to the surgeon in the management of club-foot, fractures, and diseases of the joints, gutta-percha is peculiarly adapted to fulfil certain other useful ends. Thus, melted with an equal weight of caustic potash, or chloride of zinc, it forms a convenient vehicle for the local application of these caustics. The liquor gutta-percha is an excellent substitute for flexible collodion, and may with advantage be employed as a dressing for small wounds, to protect the hands in *post mortem* examinations, to prevent excoriations, &c. In some skin diseases, e. g. eczema and psoriasis, it acts beneficially by exclusion of air, and some suppose that its topical use will render the eruption of small-pox abortive on the face. In thin sheets, gutta-percha makes a light and admirable substitute for oiled silk.

### HÆMATOXYLI LIGNUM.

*Origin.*—The logwood tree, *Hæmatoxylum*\* *campechianum*, N. O. Leguminosæ, is of medium size, and bears fragrant yellow flowers. The sap-wood is yellowish; but the inner portion or heart-wood is of a deep red colour, and is alone officinal. The tree is a native of tropical America, and has become naturalised in Jamaica.

*Characters.*—The only other medicinal red wood is red sandal wood (*Pterocarpus lignum*), which is easily distinguished by its colouring matter not being soluble in water. A fragment of logwood when chewed colours the saliva pink, and its colouring matter is soluble both in water and spirit. Logwood

\* *Αἷμα*, blood, *ξύλον*, wood, from its colour.

is usually kept in chips, or in coarse powder. The logs are always black upon the surface, and are so distinguished from Brazil wood. The wood is heavier than water, sp. gr. 1·057, and possesses an odour resembling that of violets. Its principal constituents are tannic acid, and a crystalline yellow colouring principle termed *hæmatoxylin* or *hæmatin*,  $C_{16}H_{14}O_6$ , not to be confounded with the colouring matter of blood. Oxidation of the hæmatoxylin often gives rise to iridescent metallic colours on the surface of the wood. Infusion of logwood is turned reddish-yellow by acids, and deep violet by alkalies. It precipitates ferric salts dark brown, and gelatin reddish. Logwood is much employed as a dye-wood and colouring agent in commerce.

*In Medicine.*—An excellent mild astringent, unirritating, and not tending to subsequent constipation. The decoction is the best preparation, and may be advantageously combined with dilute sulphuric acid.

The colouring matter is absorbed into the urine and fæces, and the addition of any alkali to logwood-urine develops a deep red colour.

### HEMIDESMI RADIX.

*Origin.*—The Indian sarsaparilla, *Hemidesmus Indicus*, N.O. Asclepiadaceæ, is a climbing plant, which is common over the whole peninsula of Hindostan.

*Characters.*—The root is easily known by its fragrant odour and agreeable aromatic flavour. It is said to contain *hemidesmic acid*, a volatile crystallisable substance. At one time this plant was confounded with the *Smilax aspera*, which is totally different, and even now *Syrupus Hemidesmi* is often incorrectly termed *Syrup of Smilax*.

*In Medicine.*—Although proposed as a substitute for true sarsaparilla, its only real use is as a flavouring agent, and the syrup forms an agreeable addition to pectoral and other mixtures.

## HIRUDO.

The Leech is a member of the class Annelida of the Invertebrata. It is an aquatic worm, with a flattened body, narrower anteriorly, and composed of ninety five equal and distinct projecting rings. Each extremity terminates in a sucker. In the centre of the anterior one is placed the three-cleft mouth, furnished with three cartilaginous jaws, lined on their edges with sixty or seventy fine sharp teeth set in motion by small muscles. In biting, the jaws act like very delicate curved saws, and make a triangular wound in the skin. From this wound the blood is removed by suction, and flows into the sacculated stomach. The movements of the animal are effected by muscles, arranged in circular, diagonal, and longitudinal layers. The skin is extremely susceptible to all kinds of impressions, but in the other senses, leeches are very deficient or altogether wanting.

No less than fifty different species of leech have been described, but they are very imperfectly known; and two species only are recognised in the Pharmacopœia, viz:—The speckled or English leech, and the green or Hamburgh leech. The six stripes on the back distinguish the officinal leeches from all other species that resemble them, e. g. the horse-leech.

No absolute rule can be given as to the quantity of blood a leech will draw, for it will obviously vary from several causes, but probably half an ounce is the maximum, excluding what may drain from the wound afterwards. About ʒi. to ʒij. is the usual quantity.

Leeches are largely derived from the south of Europe, and the artificial rearing of them (hirudiculture) is carried on extensively in France in marshy meadows. They are caught either by the hand, by baits (especially liver), by a kind of net,

or by the collectors going into the ponds with naked feet, to which the leeches adhere.

Leeches are hermaphrodite, but, nevertheless, require mutual impregnation, they do not produce ova until six or seven years old; and the young leeches, when hatched, are not fit to be used in medicine for several years.

*Preservation.*—Leeches are usually kept in jars of water, which should be soft and frequently changed as they are very liable to various diseases, and often die unexpectedly in great numbers, particularly if the slimy coating which forms on their skin from time to time be not removed. This slimy coating is, in reality, the exfoliated epidermis, and is not a morbid product as is commonly supposed. Leeches which are gorged with blood should be kept by themselves for they are then more prone to disease.

*Disgorgement.*—Leeches may be compelled to give up the blood which they have swallowed, by various means, e. g. salt, alum, sugar, vinegar, and many other substances. One of the best methods (Soubeiran and Bouchardat) is to place the leeches in a solution of sixteen parts of salt in one hundred of water, at 104 to 113° F. They are then to be taken out, lightly pressed when they readily disgorge the blood, and afterwards placed in fresh water. If simply left to themselves for some months they become fit for use again.

*In Medicine.*—Leeches afford a valuable and comparatively painless mode of abstracting blood locally, and, in many cases, they are preferable to wet cups, e. g. with young children, and in certain situations which do not admit of cupping, such as the gums, nostrils, or neck of the uterus. They should not be applied over a large superficial vein or nerve-trunk, nor in situations such as the scrotum, where compression could not be effectually resorted to, nor to the neck or upper part of the chest in females; but with these exceptions, they may be utilised on most parts of the body except the palms and soles.



As a general rule, avoid leeching the eyelids, vulva, penis, or mamma, lest ecchymosis, œdema, or troublesome inflammation arise.

The surface to which leeches are applied should be perfectly clean; and, if they do not bite readily, the skin may be moistened with a little blood, or milk, or the leech may be rolled for a moment in a dry towel, or immersed for a few moments in porter; but, as a rule, the less they are meddled with the better. The fumes of sulphur, vinegar, or tobacco in the room will often, it is said, effectually prevent leeches from biting at all.

Leeches can be caused to bite in a particular spot by spreading on the skin a piece of moistened blotting paper, with a hole cut in it over the desired place. A free discharge of blood may be obtained by applying a cupping-glass over the bites. They continue to draw blood until they are gorged, when they drop off, but may be dislodged at any time by sprinkling a little sugar, salt, or better still a few grains of snuff on them. Should the bleeding continue longer than is desirable, it may be arrested by continued pressure, cold water, alum, &c., or, most effectually, by a pointed stick of lunar caustic touched to the bottom of the wound. It has sometimes been necessary to transfix the wound with a fine needle and to apply a ligature. Not a few deaths have happened from hemorrhage from leech bites, and children especially should be carefully looked after.

Occasionally leeches have found their way accidentally into the nares or throat, and death has occurred from this cause. Vinegar, or solution of salt, should be given if the animal cannot be seen or detached.

Not unfrequently a fibroid growth takes place in the cicatrix of a leech bite, and forms a permanent white elevation on the skin, a miniature keloid tumour in fact. On some delicate skins

considerable ecchymosis and inflammatory irritation around the bites not unfrequently result.

### HORDEUM DECORTICATUM.

*Origin.*—Several species of barley are cultivated in different parts of the world, and the officinal one, *Hordeum distichon*, N.O. Gramineæ, is so called from having a row of perfect florets at each side of the flower-spike, and bearing two rows of seeds. The original country of the barley is not certainly known.

*Characters.*—The recent seeds are oblong, marked with a longitudinal furrow, and yellow externally. The chief constituents are starch, sugar, gum, and gluten. Pearl barley, so called from its whiteness, is the seed deprived of all its coats and afterwards rounded and polished in a mill.

*In Pharmacy.*—Barley gruel is sometimes employed as a basis for enemata, e. g. oil of turpentine.

*In Medicine.*—Dietetically, barley is a mild farinaceous food, and the decoction (barley water), flavoured with lemon and sugar, is often employed in febrile and inflammatory complaints, and is relished by patients. Barley forms a hard indigestible bread.

*Malt*, consists of the seeds caused to germinate by the aid of warmth and moisture, and afterwards baked so as to destroy their vitality. It contains a minute quantity, 0·2%, of a ferment, *diastase*, by whose agency the starch of the seed is converted into dextrin and glucose. Decoction and extract of malt are sometimes prescribed with advantage as nutrient and stimulant tonics in phthisis and other exhausting diseases. In the form of beer, porter, and ale, barley is in enormous demand, and viewed in this light, it constitutes a most important article in the *Materia Medica*.

*HYDRARGYRUM.\***TABLE OF THE COMPOUNDS AND PREPARATIONS OF  
MERCURY IN THE PHARMACOPŒIA.*

## CLASS I. METALLIC.

1. Hydrargyrum.	Hg.	
Empl. Ammon. c. Hydr.	1 part in 5.	
„ Hydrargyri.	1 „ 3.	
Hydrarg. c. Creta.	1 „ 3.	
Linim. Hydrarg.	1 „ 6.	
Pilula Hydrarg.	1 „ 3.	
Suppos. Hydrarg.	1 „ 6.	
Ung. Hydrarg.	1 „ 2.	
„ „ Comp.	1 „ 4.	

## CLASS II. OXIDES.

2. Hydrargyri Oxidum Nigrum.	Hg <sub>2</sub> O( <i>a</i> ).
Lotio Hydrargyri Nigra.	
3. Hydrargyri Oxidum Flavum.	HgO( <i>b</i> ).
4. Hydrargyri Oxidum Rubrum.	HgO.
Lotio Hydrargyri Flava( <i>b</i> ).	
Ung. Hydr. Ox. Rubri.	1 part in 8.

## CLASS III. NON-OXYGENATED (HALOID) SALTS.

5. Hydrargyri Iodidum Rubrum.	HgI <sub>2</sub> .
Ung. Hydr. Iod. Rubri.	1 part in 28.
6. Hydrargyri Iodidum Viride.	HgI.
7. Hydrargyri Perchloridum.	HgCl <sub>2</sub> .
Liq. Hydr. Perchl.	½ gr. in ʒi.

\* "Υδωρ, water; ἄργυρος, silver.

(*a*) The black or sub-oxide is not used in the dry state; it occurs only in "black wash."

(*b*) The mercuric or per-oxide is red when dry, yellow when moist, i. e. prepared by precipitation.



- |                             |                       |
|-----------------------------|-----------------------|
| 8. Hydrargyri Subchloridum. | HgCl.                 |
| Pil. Hydr. Subchlor. Comp.  | 1 part in 5.          |
| Ung. „ „ „                  | 1 „ 6.                |
| 9. Hydrargyrum Ammoniatum.  | NH <sub>2</sub> HgCl. |
| Ung. Hydr. Ammon.           | 1 part in 8.          |

## CLASS IV. OXYSALTS.

- |                                      |   |
|--------------------------------------|---|
| 10. Hydrargyri Nitratis Liq. Acidus. | Hg <sub>2</sub> NO <sub>3</sub> + xHNO <sub>3</sub> . |
| Ung. Hydr. Nitratis.                 |   |
| 11. Hydrargyri Sulphas.              | HgSO <sub>4</sub> .                                   |

*Origin*—Metallic mercury\* has been known from very ancient times; but we are indebted to the famous empiric Paracelsus, who flourished in the early part of the sixteenth century, for its administration internally.

The principal ore of mercury is the red sulphide, HgS, known as *cinnabar*, which is obtained from Spain, Idria in Carniola, China, Peru, Japan, and California. The metal is separated by heating the ore with lime, which retains the sulphur, while the mercury distils over. Quicksilver is imported in cylindrical wrought iron bottles.

*Characters of Metallic Mercury.*—The only liquid metal; it is very brilliant when pure, but tarnishes slightly on exposure, a thin crust of oxide being formed. This is chiefly if not altogether due to the presence of foreign metals, [viz., traces of lead, zinc, tin, and bismuth. If impure, the globules which form when the metal is broken up by pressure upon a flat surface, are not spherical but pyriform, owing to adhesion. Its sp. gr. 13.6, and therefore it is suited for making barometers. It boils at 662° F., and freezes at -39°, but it is slightly volatile at common temperatures. It is a good conductor of heat, and its specific heat is low; hence its selection for the manufacture of thermometers.

\* Called *Mercury* (after the messenger of the gods) from its ready mobility.

*Action of Acids.*—Mercury is not attacked by hydrochloric acid, hot or cold; the chlorides of mercury therefore cannot be prepared by the direct action of the acid on the metal. Neither is it dissolved by cold sulphuric acid, but boiling sulphuric acid, and hot or cold nitric acid, convert it into their respective salts. (See Hydrarg. Sulph., and Liq. Hydr. Nitr. Ac.)

*Chemical Relations.*—With other metals, and even with hydrogen, mercury forms soft compounds, termed *amalgams*. The smallest trace of it communicates a white stain to gold.

Mercury is normally a dyad, i. e. combines with two atoms of a monad, such as chlorine or iodine, but, in many cases, it exerts only half its power, and acts as a monad. The former class of compounds are termed *mercuric* (per) salts; the latter, *mercurous* (sub) salts, and the contrast between their formulæ, &c., will readily appear from the subjoined table of the official compounds:—

MERCURIC (PER) SALTS. Hg <sup>''</sup> .	MERCUROUS (SUB-PROTO-) SALTS. Hg <sup>'</sup> .
HgO, <i>red</i> , when dry; <i>yellow</i> , when moist.	Hg <sub>2</sub> O, always black.
Hg Cl <sub>2</sub> , corrosive sublimate; white.	HgCl, calomel; white.
Hg I <sub>2</sub> , red; when heated yellow.	HgI, yellowish-green.
NH <sub>2</sub> HgCl, "white precipitate."	.. .. ..
Hg 2NO <sub>3</sub> , colourless.	.. .. ..
Hg SO <sub>4</sub> , white.	.. .. ..
TESTS.	TESTS.
With HCl, No precipitate.	With HCl, white precipitate (calomel).
,, KHO, yellow ,,	,, KHO, black ,,
,, KI, red ,,	,, KI, yellowish-green precipitate.
,, NH <sub>3</sub> , white ,,	,, NH <sub>3</sub> , black ,,

The best general test for mercury, whether in the mercurous or mercuric state, is the *copper test*.

If any salt of mercury be heated in a test tube with a piece

of clean copper, and a few drops of hydrochloric acid, the mercury will be deposited on the copper, and can be easily separated as a colourless sublimate of minute globules by heating the copper. That is, the white metal is thrown down on the surplus red metal, an equivalent of which is dissolved; the converse of the test for copper in solution, wherein the red metal, copper, is deposited on the white metal, iron, or zinc.

Persalts of mercury are often soluble in ether (e. g. corrosive sublimate and red iodide) when their corresponding subsalts are not, and they may be thus separated from each other. Mercury and its compounds are volatile, and by distillation it can be separated from other contaminating metals. Some of its compounds are prepared by the process of sublimation, e. g. calomel, and corrosive sublimate. Several mercurial compounds are decomposed by light, e. g. green iodide, and, to a less extent, calomel, and others are decomposed by the addition of water, e. g. the sulphate and nitrate yield *yellow* basic salts.

So much confusion has arisen from change of nomenclature, and the danger of confounding the chlorides and the iodides, especially, is so serious that accuracy is particularly necessary in writing prescriptions for mercurials. The common abbreviation, viz., Hydr. Chlor., which is used for Hydrate of Chloral, may, at any moment, lead to a fatal mistake.

*Antidote.*—Albumen forms an insoluble compound with solutions of mercuric salts (corrosive sublimate), and hence the value of white of egg, milk, &c., in cases of mercurial poisoning.

*General Therapeutical Effects.*—Mercury is singled out from all the other metals by the variety of effects which can be obtained from its preparations, although “mercurialism” can be induced more or less efficiently by any of its officinal forms. The influence of mercury both locally and generally is power-



ful and extensive, and some of its preparations, e. g. corrosive sublimate and red iodide, are highly caustic and irritant. Of its *modus operandi* systematically we are still very ignorant, and within the limits of this book, it will not be possible to give more than the following summary of its salient actions and uses, which is partly taken from Dr. Scoresby Jackson's *Note-book of Materia Medica*.

1. Pure metallic mercury is probably inert in the system, and only becomes operative when it is brought into combination. At one time the mischievous and foolish custom of giving quicksilver internally prevailed largely, and ladies used formerly to swallow crude mercury to beautify the complexion. The sulphides appear to be the most inert compounds.

2. The compounds of mercury differ widely in the promptness and intensity of their action, and, according to Mialhe, all its preparations are converted in the system into corrosive sublimate by the agency of the chlorides in the digestive canal, their relative activity depending upon the facility with which they are converted into this salt. Insoluble mercurials, e. g. calomel, are variable in their action, according to the facilities for their solution and absorption. Probably the same amount of mercury in a soluble form would always produce the same effect upon the same system.

3. Mercurials tend to impair the quality and constitution of the blood, and to defibrinate it. In their general action they seem to have a special affinity for the white tissues of the body, for the articular ends of long bones, and for serous membranes, but not for the mucous membranes. They also increase the activity of some of the secreting organs, especially the salivary glands, and promote the alvine evacuations.

The first appreciable effects of medicinal doses are shown in freer discharges from the intestinal canal, but more strikingly in the mouth. The breath becomes fetid, the gums swell and are tender, there is a disagreeable coppery taste in the

mouth, and offensive ropy saliva is discharged. The tongue is slimy, sodden, and swollen, and the salivary glands are enlarged and tender. The action of mercury on the liver has been much disputed, and Dr. Hughes Bennett, as reporter of the Edinburgh Committee, appointed some few years since to investigate this question, stoutly maintains, from experiments on dogs, that mercurials in any form never occasion the slightest increase in the amount of bile secreted, but rather diminish it. But Dr. T. R. Fraser has pointed out, upon physiological and other grounds, that these experiments are not at all conclusive in the negative, and the evidence is very strong that mercury is distinctly a cholagogue, although we cannot precisely explain *how* the increased flow of bile is effected.

Dr. Murchison observes that much of the difference of opinion between the physiologist and the practical physician may be reconciled by keeping in mind the osmotic circulation which is constantly going on between the intestinal contents and the blood. "Mercury and allied purgatives produce bilious stools, by irritating the *upper* part of the bowel and sweeping on the bile before there is time for re-absorption. That mercury does act especially upon the duodenum is proved not merely by the large flow of bile which follows its action, but by the fact discovered by Radziejewski, that leucin and tyrosin, which are products of pancreatic digestion, and under ordinary circumstances are decomposed in the bowel, appear in the fæces after the administration of mercurials. It would appear, then, that mercury, by increasing the elimination of bile, and lessening the amount of bile and other products of disintegrated albumen circulating with it in the portal blood, is after all a true cholagogue, relieving a loaded liver far more effectually than if it acted merely by stimulating the liver to increased secretion, as was formerly believed, and as some authorities still maintain: for, in this case, it might be expected to increase, instead of diminish, hepatic congestion."

4. The principal evil consequences ascribed to the undue continuance or abuse of mercurials, or to idiosyncrasy, are, (*a*) excessive salivation or ptyalism, with spongy gums and ulceration of the mouth; (*b*) purging; (*c*) trembling palsy of the limbs, most usually seen among the manufacturers of mirrors. This latter affection is very chronic and little amenable to treatment; (*d*) mercurial erethismus, i. e. great vital depression, with tendency to syncope; a condition seldom or never witnessed now; (*e*) some cutaneous affections, e. g. eczema, rupia; (*f*) a depraved state of the constitution, known as mercurial cachexia.

5. Of these ill effects, *a* and *b* are the most common, and may be treated after stopping the use of the mercury, by rest, weak astringent and deodorising lotions to the mouth, such as alum, chlorate or permanganate of potassium, and hypochlorite of sodium. If mercurials purge too readily, combine them with a little opium. It is important to remember that some constitutions are so susceptible to mercury that a single dose of a mild preparation, e. g. calomel (three grs.), or so small a dose as  $\frac{1}{3}$  gr. of corrosive sublimate, may cause alarming symptoms such as those just mentioned.

In malignant yellow fever, acute inflammation of the brain, and abscess of the liver, it is often difficult, if not impossible, to induce salivation by the freest exhibition of mercury internally and externally.

6. The internal administration of iodide of potassium (Melsens) is the best means of facilitating the removal of mercury from the system.

7. The principal contra-indications to the use of mercurials are very exhausting diseases, e. g. scurvy, or wherever there is a tendency to serious chronic textural degeneration, e. g. fatty heart, chronic Bright's disease, anæmia, and advanced scrofulous, or tuberculous disease.

8. Young children, i. e. below ten years, are difficultly salivated: the mercury passes off by the bowels and gives the

evacuations a fetid odour, and the peculiar green appearance often compared to chopped spinach. This colour is probably due to altered colouring matter of the blood.

9. The persalts are very much more active than the subsalts, e. g. the average dose of corrosive sublimate is about  $\frac{1}{12}$  gr., of calomel, two to three grs. Grey powder, blue pill, and calomel are the mildest preparations.

10. Internally, the most important uses of mercurials are, (*a*) in full doses, as purgatives, cholagogues, and anti-febrile remedies; (*b*) in smaller, the so called alterative doses, in secondary and tertiary syphilitic affections, especially the former, but care must be taken not to push the mercury too far; (*c*) to promote absorption and resolution of the *products* of inflammation.

Externally, mercurial preparations are used to destroy parasites, whether of an animal or vegetable nature, e. g. pediculi and ringworm; as stimulants to the skin in chronic inflammation, especially eczema; as caustics, &c.

11. Mercury can be detected, after a course of it, in most of the solids and fluids of the body, including the blood, and is retained with peculiar tenacity in the liver.

12. The different methods of administering mercurials are, (*a*) by the mouth—the usual mode. Law's method of inducing speedy salivation consists in administering  $\frac{1}{12}$  gr. of calomel every hour for twenty-four hours. Salivation can frequently be produced by two or three grs. of the medicine given in this way.

(*b*) By the rectum, as a suppository.

(*c*) By the skin—either by simple inunction upon the skin (epidermically); by dressing a blistered surface with Ung. Hydr. (endermically); or by injecting a solution of corrosive sublimate or other salt under the skin (hypodermically). This latter method is liable to give rise to local irritation and inflammation.

Neumann has shown that in the inunction of mercurial ointment on an unbroken skin, globules of mercury pass into the

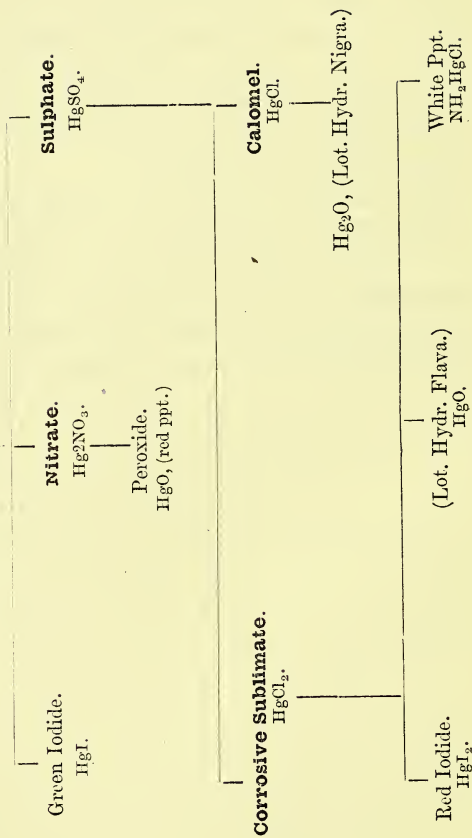
hair-sheaths and bulbs, also into the sebaceous glands, and into the upper portions of the sweat glands, from which parts it is probably absorbed as corrosive sublimate. Mercury does not penetrate the horny epidermis, and cannot be detected by chemical means in the subcutaneous tissue. Mr. Marshall recommends oleate of mercury (containing 5, 10, or 20% of mercuric oxide), as a most advantageous and cleanly substitute for the ordinary mercurial liniments or ointments. Combination with a little morphia, one gr. to ʒi. of the oleate, relieves pain and allays nervous irritation.

Infants are most conveniently influenced by the epidermic method, a little mercurial ointment being rubbed into the soles of the feet, or applied on a flannel roller smeared with the ointment and wrapped round the body or limbs.

(*d*) By fumigation of the body, either with the dry or moist fumes of calomel or other preparation.

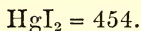
GENEALOGICAL TABLE OF THE MERCURIAL COMPOUNDS.

From Metallic **Mercury**, Hg, are prepared:—

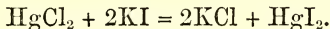




## HYDRARGYRI IODIDUM RUBRUM.



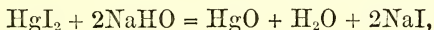
*Preparation.*—Mix boiling solutions of iodide of potassium and corrosive sublimate—



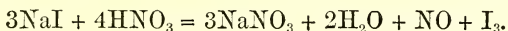
Filter, wash, and dry. Since the precipitate is soluble in both mercuric chloride and potassic iodide, excess of either salt must be avoided, and the quantities (four ounces and five ounces) ordered in the Pharmacopœia are as nearly as possible in molecular proportion. It is no disadvantage to have the iodide of potassium slightly above the theoretical quantity. With excess of potassic iodide, ( $\text{HgI}_2$ ,  $2\text{KI}$ ) is formed, and with excess of mercuric chloride, ( $\text{HgI}_2$ ,  $2\text{HgCl}_2$ ).

*Characters and Tests.*—Distinguished from all other red compounds (red lead—red precipitate), by turning yellow when gently heated, and becoming red again upon friction, or after cooling. While in the yellow form the crystals are rhomboidal prisms; in the red form, they are octahedral, i. e. this salt is dimorphous. Sp. gr. 6.3. The best solvents for it are ether and iodide of potassium.

The iodine is detected in it by digesting it with soda—



Filter from the precipitated mercuric oxide, add to the solution of iodide of sodium starch paste and a little nitric acid, when blue iodide of starch is formed—

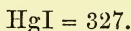


The mercury may be set free and sublimed in globules by heating the iodide with dried sodic carbonate in a test tube.

*In Medicine.*—A powerful irritant poison. Topically applied

in lupus, &c. In goitre, the continued application of the ointment, or of a lotion of the red iodide with potassic iodide and glycerin, will sometimes exert a remarkable influence in dispersing the tumour. The ointment is liable to bring out a papular eruption. The salt is given internally in solution, with iodide of potassium, and the resulting solution is colourless. The double iodide of mercury and sodium has been proposed for hypodermic use, as less likely to cause local irritation than corrosive sublimate. Donovan's solution (Liq. Arsen. et Hydrarg. Iod.), formerly officinal in the Dublin Pharmacopœia, is an aqueous solution of double iodide of mercury and arsenic.

### HYDRARGYRI IODIDUM VIRIDE.



*Preparation.*—Combine the mercury and iodine directly in proper atomic proportions, triturating with a little spirit of wine, which dissolves the iodine, and, by its evaporation, prevents the temperature rising too high.  $\text{Hg} + \text{I} = \text{HgI}$ . Dry in the dark, and keep from the light.

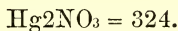
*Characters and Tests.*—A green or yellow powder, insoluble in ether. It varies in colour according to the mode of its preparation, and the degree of exposure to light, under the influence of which it becomes of a dark olive colour, or even black, and is partially decomposed— $2\text{HgI} = \text{HgI}_2 + \text{Hg}$ . The colour of pure mercurous iodide is yellow. Owing to exposure or to faulty preparation, it is apt to contain some of the poisonous red iodide, which is easily detected by its solubility in ether. If heated in a test tube, the iodide is decomposed, as by light, yields a yellow sublimate ( $\text{HgI}_2$  in yellow form) in the cooler part of the tube, and a deposit of metallic mercury is left at the bottom. If rapidly heated, however, mercurous iodide may be sublimed unchanged. Practically, the so called green iodide really consists of a mixture of mer-

curous and mercuric iodides, and mercury, in varying proportions.

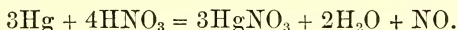
*In Medicine.*—On account of its uncertainty of composition, and liability to change, with consequent formation of red iodide, it should never be prescribed, and ought to be rejected from the Pharmacopœia.

If given along with iodide of potassium, it would be converted into red iodide of mercury, and dangerous consequences might ensue.

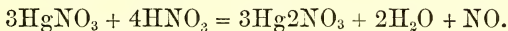
### HYDRARGYRI NITRATIS LIQUOR ACIDUS.



*Preparation.*—Dissolve mercury in cold, slightly diluted nitric acid. Mercurous nitrate is first formed—

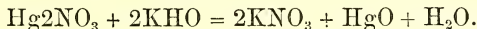


On boiling the solution with the excess of acid the mercurous is converted into mercuric nitrate :—



In the officinal process the acid is in excess; the solution consequently contains free nitric acid, and is so rendered more stable.

*Characters and Tests.*—With excess of caustic potash it gives a yellow precipitate of mercuric oxide :—



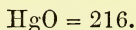
Since it contains free nitric acid, the solution blackens a crystal of ferrous sulphate dropped into it, owing to absorption of nitric oxide (See Ac. Nitricum). The absence of mercurous nitrate is proved by the liquid not giving any precipitate when dropped into diluted hydrochloric acid. (See p. 357, tests for mercury.) By addition of water the solution is decomposed and basic insoluble oxy-nitrates of different composition can be obtained.

*In Medicine.*—Only used externally as a caustic in cancerous affections, acne, lupus, &c. A minute drop applied by a pointed glass rod will often effectually disperse acne pimples. A yellowish white scab is produced; but, if carefully used, and any excess removed by blotting paper, no scar is left.

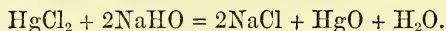
The well-known citrine ointment (Ung. Hydr. Nitratis), popularly called *golden ointment*, is an ointment of mercuric nitrate, prepared with a still larger excess of acid. This ointment does not usually keep well, but turns grey and becomes hard. It is much used in ophthalmic and cutaneous affections.

Nitrate of mercury developes a pale red colour with albuminous or gelatinous substances, rapidly when heated, but slowly in the cold.

### HYDRARGYRI OXIDUM FLAVUM.



*Preparation.*—Add corrosive sublimate to excess of solution of soda—



*Characters and Tests.*—This form of mercuric oxide differs only physically from the red oxide in colour and in being in a more minute state of division. By exposure to light it acquires a grey colour.

*In Pharmacy.*—This oxide is better adapted than the red crystalline oxide for use in ointments, especially for ophthalmic purposes, because it is free from grittiness. It is also the form of oxide employed in the preparation of the oleates of mercury recently brought into notice by Mr. Marshall.

### HYDRARGYRI OXIDUM NIGRUM.

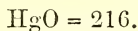
Occurs in Lotio Hydr. Nigra, forming the greyish-black sediment.

*Preparation.*—Mix calomel (30 grs.) with lime water (3x.) :—  
 $2\text{HgCl} + \text{CaO} = \text{Hg}_2\text{O} + \text{CaCl}_2$ .

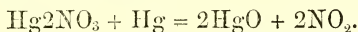
Some of the calomel remains undecomposed, being in excess. Caustic potash or soda would answer instead of the lime water.

*In Medicine.*—Much used as a local application to syphilitic ulcers, balanitis, eczema, &c. Shake before applying it.

## HYDRARGYRI OXIDUM RUBRUM.



*Preparation.*—Heat dry mercuric nitrate with an additional equivalent of metallic mercury—



If the mercuric nitrate were heated by itself, some available oxygen would go to waste :— $\text{Hg}_2\text{NO}_3 = \text{HgO} + 2\text{NO}_2 + \text{O}$ .

*Characters and Tests.*—An orange red or scarlet lustrous powder, formerly called *nitric oxide* to distinguish it from the product obtained by roasting the metal directly in air, but commonly known as *red precipitate*, because it used to be prepared by precipitation. Sp. gr. 11·30. In fine powder or when precipitated in the *moist* condition, e.g. from corrosive sublimate by potash, it is *yellow*, but this when dried becomes red. The yellow form is simply in a more minute state of division than the red; there is no chemical difference between them.

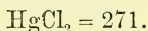
When long exposed to light it is partially reduced. By a gentle heat it is rendered temporarily darker in colour, and, at a higher temperature, is resolved into mercury and oxygen. It is almost insoluble in water (1 in 7000), and in cold alcohol, and ether. It is readily dissolved by nitric acid, as also by hydrochloric, acetic, and hydrocyanic acids, without effervescence, and the resulting solution gives the usual mercuric reactions

with caustic potash and ammonia. (See p. 357.) Any fixed impurity such as brick-dust or red lead, is detected by its not being volatilisable at a low red heat. Freedom from any undecomposed nitrate is shown by no orange nitrous vapours being given off when the oxide is heated in a test tube.

*In Pharmacy.*—Used only in making the Ung. Hydr. Ox. Rubri. This ointment becomes slate coloured after a time, because mercuric oxide in contact with some organic matters, e.g. fat, is liable to reduction to the mercurous (black) oxide. If unwashed lard have been carelessly used in its preparation, the ointment becomes white from the formation of mercuric chloride by the common salt in the lard.

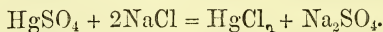
*In Medicine.*—Not used internally. Employed externally as a stimulant and caustic to chancres, indolent ulcers, &c., either as ointment, or dusted over the surface in fine powder. The ointment, if intended for ophthalmic use, should be prepared with the precipitated yellow oxide, which is not gritty. “Yellow wash” (Lotio Hydr. Flava) contains mercuric oxide in a fine state of division, and is made by adding corrosive sublimate (18 grs.) to lime water (℥x.)— $\text{HgCl}_2 + \text{CaO} = \text{HgO} + \text{CaCl}_2$ .

## HYDRARGYRI PERCHLORIDUM.



Corrosive sublimate has been known among the Chinese from remote times, and a process for its preparation was described by the Arabian chemist Geber in the eighth century.

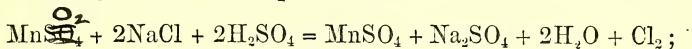
*Preparation.*—Sublime dry mercuric sulphate with  $\frac{4}{5}$  of its weight of dried chloride of sodium



The corrosive sublimate condenses in the cooler part of the apparatus. The formation of any subchloride (calomel) is prevented by previously mixing 2 or 3% of black oxide of man-



ganese ( $\text{MnO}_2$ ) with the ingredients. This ensures the liberation of a little chlorine from the common salt, for two reasons. First, the mercuric sulphate is never a strictly neutral salt, but contains a slight excess of sulphuric acid—



and again, the oxide of manganese eliminates chlorine from some of the chloride of sodium, manganate of sodium and a lower oxide of manganese being simultaneously produced.

*Characters and Tests.*—A heavy, crystalline mass, sp. gr. 5·2, soluble in sixteen parts of cold, and in three, of boiling water. Ether dissolves it readily (1 in 3), and will even abstract it to a considerable extent from its aqueous solution when agitated with it. By its solubility in hot water, and in ether, it is easily distinguished and separated from calomel. Nitric, sulphuric, and hydrochloric acids dissolve it without decomposition. Its solution gives the usual mercuric reactions with potash and ammonia (see p. 357), and the reaction for chlorides with nitrate of silver. Sal-ammoniac, and other alkaline chlorides, considerably increase the solubility of corrosive sublimate in water, and with the former, a stable double salt, *sal alembroth* ( $2\text{NH}_4\text{Cl}, \text{HgCl}_2, \text{H}_2\text{O}$ ) is formed, as in the *Liq. Hydr. Perchlor.*, which contains  $\frac{1}{2}$  gr. of mercuric chloride in  $\text{ʒi}$ . A simple dilute watery solution of sublimate is liable to decomposition, calomel being precipitated, and oxygen evolved. The solution is also decomposed by exposure to light in contact with organic substances, and is partially reduced to the metallic state.

*In Pharmacy.*—Used in the preparation of “yellow wash,” “white precipitate,” and red iodide of mercury.

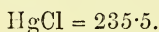
*In Medicine.*—A powerful and irritant mercurial. In over doses it acts as a violent corrosive poison, causes excruciating pain in the stomach and bowels, vomiting, diarrhœa, cold sweats, cramps, prostration, and death. The average dose in-

ternally is  $\frac{1}{12}$  gr., given in solution with iodide of potassium, or as the Liq. Hydr. Perchlor., after meals.

Externally, corrosive sublimate is occasionally employed as an injection in gleet ( $\frac{1}{4}$  gr. to  $\bar{3}$ i.), and a stronger solution (2 grs. and upwards in  $\bar{3}$ i.) in tinea versicolor and ringworm. A sublimate lotion often allays troublesome itching; but it should be remembered that death has resulted in several cases from the external use of a strong solution or ointment of sublimate to young people.

Corrosive sublimate, from its antiseptic powers, is sometimes employed for preserving anatomical preparations.

### HYDYARGYRI SUBCHLORIDUM.



Calomel\* has been known for about two and a half centuries, but Christison states that in Scotland it seems to have been a rare drug in 1666.

*Preparation.*—As the perchloride of mercury was obtained by subliming the persulphate with chloride of sodium, so the subchloride is similarly obtained from the subsulphate— $\text{Hg}_2\text{SO}_4 + 2\text{NaCl} = \text{Na}_2\text{SO}_4 + 2\text{HgCl}$ . Sublime into a *large* chamber, so as to procure a fine powder. The mercurous sulphate is prepared by rubbing up mercuric sulphate with metallic mercury. The calomel, as sublimed, is liable to contain a little corrosive sublimate, a dangerous admixture, hence the product is washed with *hot* water, which removes any trace of the perchloride. Even while volatilising, the calomel is temporarily decomposed into mercury and corrosive sublimate, re-combination ensuing

\* From *καλός*, good; *μέλας*, black; the term calomel having been formerly applied to the black sulphide of mercury. According to others, this name was given to the subchloride by Sir T. Mayerne, in compliment to a negro who assisted him in preparing it.

as condensation takes place. For this reason the density of its vapour cannot be satisfactorily determined by experiment.

Calomel is directed to be kept from the light, as it is partially decomposed and darkened in colour by exposure.

*Characters and Tests.*—It is the only insoluble officinal chloride except “white precipitate,” from which it is distinguished by its insolubility in acetic acid, and by its being blackened by ammonia and potash.

The powder is rendered yellow by trituration or a gentle heat, and a lump of calomel gives a yellowish streak when scratched. It usually occurs as a dull white powder, but can be obtained in fibrous crystalline cakes by sublimation in a small vessel. Sp. gr. 7·2. It is less volatile than corrosive sublimate, and is not acted upon by agitation with hot water, alcohol, or ether, or by dilute acetic, hydrochloric, or nitric acids.

By means of potash or soda the black oxide is precipitated— $2\text{HgCl} + 2\text{KHO} = \text{Hg}_2\text{O} + 2\text{KCl} + \text{H}_2\text{O}$ . A similar decomposition occurs in *Lotio Hydr. Nigra*. With prussic acid, calomel undergoes a curious reaction, and is blackened, owing to separation of metallic mercury— $2\text{HgCl} + 2\text{HCy} = \text{HgCy}_2 + 2\text{HCl} + \text{Hg}$ .

Fixed impurities, such as chalk or sulphate of barium, would be left behind on applying a sufficient heat.

*In Pharmacy.*—Enters into Plummer’s pill (*Pil. Hydr. Subchlor. Co.*) and *Ung. Calomelanos*. Calomel should not be prescribed along with iodide of potassium, or nitro-muriatic acid, which convert it, respectively, into red iodide, and corrosive sublimate. Prussic acid, bitter almonds, and laurel water, also convert it into mercuric salt, more or less. (See above.)

*In Medicine.*—One of the most frequently used mercurials—(a) to bring the system under the general influence of mercury, (b) as a purgative, and (c) as an anthelmintic. It is well adapted for children on account of its tastelessness, mild operation, and facility of administration, and as a cathartic, is frequently

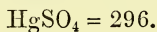
combined with other purgatives, viz.:—Jalap, rhubarb, aloes, scammony, colocynth, and gamboge.

The free use of chlorides, or of salt meat, and of vegetable acids, e. g. sour fruit, intensifies the action of calomel by converting it more or less into soluble mercuric salts. A common formula for a cathartic bolus consists of five grs. calomel, ten to twenty grs. jalap, and two grs. ginger, made up with sufficient treacle. Large doses are said to act as a sedative.

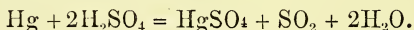
In reference to the absorption of calomel, Mr. Tuson has made some interesting experiments. He has shown that although neither dilute muriatic acid (2%) nor pepsin alone is capable of dissolving calomel, yet when these two are mixed they do effect its solution. Consequently, the digestion of calomel, so far as its solution in artificial gastric juice is concerned, is brought about under the same conditions as that of the albumenoids.

Externally, calomel is sometimes dusted over opacities of the cornea, and applied as an ointment to some cases of eczema. If used locally to the eye, it is said that iodide of potassium should not be administered internally at the same time, else conjunctival inflammation may result.

### HYDRARGYRI SULPHAS.



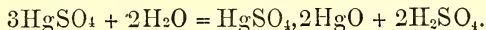
*Preparation.*—Heat mercury with sulphuric acid; abundant fumes of sulphurous acid gas escape—



Cold sulphuric acid does not act upon mercury.

*Characters.*—A heavy white powder, decomposed by water into a soluble acid sulphate, and an insoluble *yellow* oxysulphate ( $\text{HgSO}_4, 2\text{HgO}$ ) called *Turpeth mineral*, from its resemblance in

colour to the powdered root of *Ipomæa Turpethum* (N. O. *Convolvulaceæ*), an Indian substitute for jalap :—



The salt is liable to contain a little free sulphuric acid. (See Hydr. Perchlor.)

*In Pharmacy.*—Forms the source of the chlorides of mercury. Used in some zinc-carbon voltaic cells. (Gaiffe).

*In Medicine.*—Possesses powerful emetic and errhine qualities, but is not now prescribed.

### HYDRARGYRUM.\*

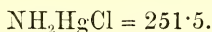
$$\text{Hg} = 200.$$

*Origin and Characters.*—See p. 356.

*In Pharmacy.*—A considerable number of preparations contain mercury, chiefly in the metallic state, but yet partially oxidised, the proportion of oxide varying according to the age of the specimen. The most important of these preparations are Hydr. c. Creta (grey powder); Pil. Hydr. (blue pill); and Ung. Hydr. (blue butter). In these, the mercury is rubbed up with chalk, liquorice powder, or lard, respectively, until metallic globules are no longer visible to the unaided eye.

*In Medicine.*—See p. 358.

### HYDRARGYRUM AMMONIATUM.



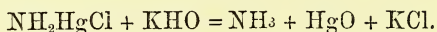
“White precipitate” has been known for about 400 years.

*Preparation.*—Add solution of corrosive sublimate to ammonia— $\text{HgCl}_2 + 2\text{NH}_3 = \text{NH}_2\text{HgCl} + \text{NH}_4\text{Cl}$ . Filter, wash away the sal-ammoniac ( $\text{NH}_4\text{Cl}$ ), and any excess of ammonia, as shown

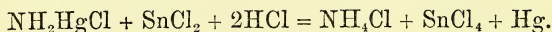
\*“Υδωρ, water; ἄργυρος, silver, in allusion to its appearance; hence also its common name of *quick* (i. e. living) *silver*.

by the washings ceasing to precipitate acidulated solution of nitrate of silver. Prolonged washing converts some of the white precipitate into a yellow compound,  $(\text{NH}_2\text{HgCl}, \text{HgO})$ . If the order of mixing the solutions were reversed, the precipitate would have the composition,  $\text{NH}_2\text{HgCl}, \text{HgCl}_2$ , and would contain 76.5% of mercury.

*Characters and Tests.*—Excepting calomel this is the only insoluble chloride used in medicine, and it is easily distinguished from the former by not being blackened by ammonia or potash. It has an unpleasant metallic taste, and is decomposed by the ordinary mineral acids and caustic alkalies. It is readily and wholly soluble without effervescence in warm hydrochloric, nitric, and acetic acids, forming colourless solutions. In constitution, it corresponds to sal-ammoniac,  $\text{NH}_4\text{Cl}$ , in which  $\text{H}_2$  are replaced by one atom of dyad mercury; i. e. it is the chloride of mercur-ammonium, and behaves as a mercuric salt. Proved to be an ammoniacal compound by evolving ammonia when digested with caustic potash, while at the same time, yellow oxide of mercury is precipitated:—



The presence of mercury is further shown by the grey (calomel + mercury), and finally black deposit of metallic mercury formed, when it is boiled with acid solution of stannous chloride (*maggie* test).



Fixed impurities, e. g. white lead, chalk, &c., are detected by exposing it to a strong heat, when it should entirely volatilise *without fusing*. The latter character distinguishes the officinal compound from another variety of white precipitate, known as “fusible white precipitate,”  $\text{NH}_2\text{HgCl}, \text{NH}_4\text{Cl}$ , which contains 14% less mercury. This was formerly prepared by adding a fixed alkali to a mixed solution of corrosive sublimate and sal-



ammoniac. The officinal precipitate contains 79·52% of mercury.

*In Medicine.*—Extensively used as an external application in the form of ointment (1 in 8). In chronic eczema particularly it is one of the best local remedies, and when applied carefully and regularly will often effect a cure in the most obstinate cases. It is a useful parasiticide in the treatment of ringworm and pedicular diseases.

### HYDRARGYRUM CUM CRETA.

*Preparation.*—Rub metallic mercury with chalk until the metal is “extinguished,” i. e. until distinct globules cease to be visible. Mercury can be similarly reduced to a state of fine division by trituration with magnesia, honey, or lard. (Ung. Hydr.)

*Characters and Tests.*—Commonly called “grey powder.” The admixed chalk can be readily separated by dilute muriatic acid, which does not affect the metal, but if any mercuric oxide were present, corrosive sublimate would be formed, and the solution would give a greyish black precipitate of mercury with chloride of tin:— $\text{HgCl}_2 + \text{SnCl}_2 = \text{SnCl}_4 + \text{Hg}$ . (See Hydr. Ammon.)

*In Medicine.*—A mild and useful mercurial, well adapted for children. The chalk is an useful accompaniment as an antacid, and the addition of a little dried carbonate of sodium forms an admirable alterative combination, suitable in the treatment of some cases of diarrhœa, of certain skin diseases, and of syphilis in children.

It is best given in powder, and not in pill.

## HYOSCYAMI\* FOLIA.

*Origin and Characters.*—The common henbane, *Hyoscyamus niger*, N. O. Solanaceæ, is an indigenous plant, and, although rather rare, is found in many places in Ireland, in waste plots near towns, and on sand hills along the coast, and generally favours a calcareous soil. It is an annual or biennial plant, about two or three feet high, with a tapering, white, fleshy root, which has been mistaken for parsnip, with fatal results. The erect branching stem, which appears in the second year, is well furnished with sessile, oblong leaves, deeply lobed, and remarkable for their hairiness and viscosity. The flowers are in long one-sided cymes, with a lurid yellow corolla, usually variegated with purple branching veins. The fruit is a spheroidal, two-celled capsule, containing numerous reniform seeds, and is enclosed in the persistent urn-shaped calyx, while the top separates as a lid by a transverse slit, i. e. circumscissile dehiscence (pyxidium). The whole plant has a disagreeable rank smell, somewhat like that of tobacco, and all parts of it are active, especially the seeds. But its efficacy depends much upon the time when it is gathered; and plants of the *second year* should alone be selected, since the first year's plant is nearly inactive. Mr. Donovan has shown that so much as  $\bar{3}$ i. of the tincture, carefully prepared from leaves of one year's standing, could be taken at once without any inconvenience beyond dryness of the throat and fauces. Other species, *H. albus* and *H. aureus* exist, but are not employed in medicine. The most important constituent is a crystallisable alkaloid, first isolated by Geiger and Hesse, termed *hyoscyamia*, which is closely allied to atropia, and exists in the plant in combination with malic acid. The formula of hyoscyamia is not yet certainly determined, and there is no characteristic test for it. Höhn suggests

\* Ὕς, a sow; and κύαμος, a bean

that hyosecyamia may possibly be regarded as atropia, in which H is replaced by methyl-ammonium,  $\text{CH}_3\text{H}_3\text{N}$ .

One pound of the seeds will yield about twenty grs. of sulphate of hyosecyamia, but, owing to various circumstances, the yield of alkaloid is very variable.

The American resinoid substance, termed *hyosecyamin*, is not to be confounded with the pure alkaloid hyosecyamia or hyosecyamin.

*In Pharmacy.*—A succus, similar to Succus Conii, has been introduced, which is far preferable to the extract or tincture. The extract is a variable and unreliable preparation.

The micro-spectroscope will immediately decide whether the tincture has been made from the biennial plant; five dark bands are distinctly seen, which are not visible in that made from the annual plant (Stoddart). Mr. Donovan's test is:—Add a little of the tincture to a glass of water; if the mixture become slightly milky, the tincture was made from a two years old plant; if it remain clear and transparent, the plant was in its first year.

Preparations of henbane should not be prescribed in combination with caustic potash and soda, for Liebig and Garrod have shown that fixed alkalies destroy the therapeutic qualities of hyosecyamus as well as of stramonium, tobacco, and belladonna, e. g. 3i. of Tinct. Hyosecy. is rendered inert by ten m. of liquor potassæ; and atropia, when mixed with a little caustic potash, loses all power of dilating the pupil.

*In Medicine.*—(a.)\* *Physiological action.* Small doses ( $\frac{1}{40}$  gr. sulphate of hyosecyamia) reduce the pulse; but in larger doses ( $\frac{1}{16}$  to  $\frac{1}{12}$  gr.), it accelerates the pulse for a short time, and then depresses it; the tongue becomes dry and brown, the hard and

\* The following account is abstracted from Dr. J. Harley's admirable work, *The Old Vegetable Neurotics*.

soft palates rough and glazed, giddiness and somnolency set in, and after a time, a sticky, acid, offensive secretion forms in the mouth, similar to that which follows the action of belladonna. The pupils slowly and gradually dilate. Still larger doses cause a wakeful quiet delirium, or excessively dreamy somnolence, with muscular prostration, and very large doses may cause death.

*Modifying Influences.*—The action of henbane is modified by the same conditions as in the case of belladonna. (See Belladonna). Of these, the most important practically is *age*. Children bear enormous quantities (3i.) of the succus or tincture with impunity, while old persons are readily influenced and delirium is easily caused. It is therefore necessary to be cautious in administering henbane to those of advanced age, and especially when this is conjoined with great muscular weakness.

The action of henbane on the lower animals is essentially the same as on man, at least in the cat, dog, and mouse, although it is asserted that the leaves are eaten with impunity by horses, cows, sheep, goats, and swine. Error may have arisen from experimenting with the annual instead of the biennial plant. Like atropia, hyoscyamia is wholly eliminated by the kidneys, and its presence may be detected in the urine, by its dilating effect on the pupil of an animal, eighteen minutes after the subcutaneous injection of  $\frac{1}{48}$  gr. of the sulphate. It acts as a diuretic, and increases the excretion of urea, sulphates, and phosphates. Compared with belladonna, the influence of henbane on the cerebrum and motor centres is greater, while its stimulant action on the sympathetic is less, and indeed its effects very closely resemble those produced by the combined action of hemlock and opium. It does not constipate nor check the secretions generally like opium, but rather tends to relax the bowels.

(b.) *Therapeutic Application.*—Chiefly used now to relieve pain, procure sleep, and quiet irregular nervous action; and Harley states that in neuralgia of the internal viscera, especi-

ally of the genito-urinary organs, it is more efficacious than belladonna. As a rule, in convulsive disorders it is contra-indicated, for although it undoubtedly exercises a considerable depressing influence on the corpora striata, it fails to diminish the excitability of the spinal centre, if it does not actually exalt it. Dr. Oulmont, on the contrary, sets a very high opinion on its value in certain spasmodic and convulsive neuroses, especially in mercurial trembling, and also in paralysis agitans and senile trembling.

Henbane is most useful as a general sedative to the heart,  $\frac{1}{48}$  gr. of sulphate of hyoscyamia subcutaneously in cardiac and pulmonary asthma, and in some spasmodic affections, especially of the uterus, bladder, and urethra. The extract is often added to griping cathartics (Pil. Coloc. et Hyoscy.), with the view of correcting their disagreeable effects. In the absence of hyoscyamia, the succus only should be prescribed.

### INFUSA.

An Infusion is an aqueous vegetable solution obtained *without* the aid of continued ebullition.

Of the twenty-eight infusions, nearly all, viz., twenty-four are prepared, (*a*) by pouring pure boiling water on the vegetable substance (generally  $\frac{1}{4}$  or  $\frac{1}{2}$  oz. to  $\tilde{3}$ x.), bruised, cut small, or in coarse powder, and placed in a covered earthenware vessel of suitable construction, such as Mr. Squire's infusion jar. The usual time allowed is half an hour or an hour, but, in some cases, where the active ingredient is a volatile oil, the infusion is carried on for fifteen minutes only, so as to avoid loss, c. g. chamomile and orange peel. In one case, linseed, four hours are directed, on account of the sparing solubility of its mucilaginous matter, and in every case except kousso, the infusion after cooling is to be strained. (*b*) Two infusions, viz., chiretta and cusparia are prepared with water at 120° F.;

and (e) two, viz., calumba and quassia are prepared with cold water.

All the infusions will darken persalts of iron, on account of their vegetable basis including more or less tannic acid, except calumba and quassia, also a simple infusion of gentian, which are quite compatible with iron.

Infusions should be made recently and in small quantities, as they do not keep well, especially in warm weather. Concentrated infusions preserved by the addition of spirit, fluid extracts in fact, are sometimes kept in stock, and diluted with water to the proper strength when required, but the presence of spirit is objectionable.

The average dose of an infusion, as of a decoction, is  $\text{ʒi}$ , but Infus. Digitalis is usually given in smaller doses.

Many of the infusions are employed as tonics, and are much used as the basis of prescriptions, e. g. infusions of calumba, quassia, cascarilla, cinchona, and gentian; some are purely astringent, e. g. catechu, krameria, and matico; rhubarb and senna are purgative; kousso is anthelmintic; and buchu and uva ursi are considered diuretic and astringent.

### INFUSUM ANTHEMIDIS.

Is of a pale amber colour; yields a deep blueish-black precipitate with ferric chloride, and a yellow precipitate with acetate of lead. Possesses the aromatic odour and taste of the flowers, and is occasionally given cold as a tonic, or freely in the tepid state to assist the operation of emetics. In order to avoid dissipating the volatile oil the flowers are infused for a quarter of an hour only.

### INFUSUM AURANTII.

#### INFUSUM AURANTII COMPOSITUM.

Either would form a grateful stomachic vehicle for other me-



dicines, and it seems useless to retain two so closely similar preparations. Both are prepared in fifteen minutes.

### INFUSUM BUCHU.

Frequently combined with *Liquor Potassæ*; but, on account of its tannin, is incompatible with salts of iron. With some astringent vegetables, e. g. *Tinct. Krameriæ*, a turbid brick red mixture is obtained.

### INFUSUM CALUMBÆ.

Cold water is directed, in order to avoid extracting the starch of the root, which would hasten the decomposition of the infusion; but, in any case, this infusion spoils quickly. Not affected by salts of iron, but yields a grey precipitate with tincture of galls. This infusion, along with bicarbonate of soda, constitutes an excellent combination for flatulent dyspepsia; tincture of senna may be added if necessary.

### INFUSUM CARYOPHYLLI.

A clear, dark brown solution, which reddens litmus, gives a black precipitate with ferrous sulphate, a light brown with acetate of lead, and a pale brown flocculent precipitate with lime water. Seldom used in practice, although it affords a good vehicle for cordial draughts.

### INFUSUM CASCARILLÆ.

A light brown solution, not affected by tincture of galls or by ferrous sulphate, but with ferric chloride it acquires a darker colour.

An agreeable aromatic tonic, forms a good vehicle for either acids or alkalies.

## INFUSUM CATECHU.

A dark brown solution, which gradually deposits a copious pale brown sediment. A convenient mode of administering catechu alone, or in combination with other astringents.

## INFUSUM CHIRATÆ.

A clear, dark brown solution, which becomes dark green with salts of iron. A simple bitter tonic.

## INFUSUM CINCHONÆ FLAVÆ.

A turbid solution, of comparatively feeble power, being only  $\frac{1}{80}$  the strength of the Extr. Cinch. Liquidum.

## INFUSUM CUSPARIÆ.

A tonic, but seldom prescribed in modern practice.

## INFUSUM CUSSO.

The large dose (ʒiv. to ʒviij.), and the retention of the bulky dregs in this infusion, are serious drawbacks to its use.

## INFUSUM DIGITALIS.

The weakest of the infusions. Frequently prescribed as a cardiac stimulant and diuretic.

## INFUSUM DULCAMARÆ.

Seldom ordered now. Dr. Garrod has given as much as three pints of the concentrated infusion during the day, and with no unpleasant symptoms or good results.

## INFUSUM ERGOTÆ.

A common form of administering ergot; it is not always strained before use. A good hæmostatic.

## INFUSUM GENTIANÆ COMPOSITUM.

This infusion spoils quickly. Although gentian is devoid of tannin, this preparation blackens iron salts, on account of the tannic acid in the orange and lemon peel.

## INFUSUM KRAMERIÆ.

Becomes very turbid on cooling. A simple astringent.

## INFUSUM LINI.

A popular demulcent, under the name of "flaxseed tea." It reddens litmus, owing to the presence of free acetic acid.

## INFUSUM LUPULI.

An aromatic bitter tonic, of very nauseous taste.

## INFUSUM MATICÆ.

A very feeble astringent, rather an aromatic stimulant.

## INFUSUM QUASSIÆ.

Cold water is used as it affords a clearer infusion than hot water. A colourless bitter solution; considered to be a specially good tonic for inebriates.

## INFUSUM RHEI.

A gentle laxative; the basis of the common "Haustus Rhei." Reddened by alkalies; rendered green by perchloride of iron.

The stronger acids and most metallic solutions are incompatible with this infusion.

### INFUSUM ROSÆ ACIDUM.

A beautiful red solution when recent, but it bleaches gradually on exposure. An excess of any alkali turns it green. Acetate of lead should not be prescribed with this infusion, because insoluble and inert sulphate of lead would be formed. It is essentially nothing but an agreeable form of giving dilute sulphuric acid, since the red roses are of little medicinal value. Often used as a vehicle for other medicines, e.g. sulphate of magnesium ("red mixture"), or sulphate of quinine. With the latter, some of the quinine is precipitated as tannate, but if nitric acid be substituted for the sulphuric acid, the red colour is preserved longer, and less precipitation occurs.

### INFUSUM SENEGÆ.

Occasionally prescribed as a stimulating expectorant.

### INFUSUM SENNÆ.

On exposure to the air it deposits a yellowish sediment which is said to aggravate its griping tendency. Well known under the name of "senna tea," and it forms the basis of the common "black draught," represented by the Mist. Sennæ Comp.

### INFUSUM SERPENTARIÆ.

A tonic, seldom prescribed in modern practice.

### INFUSUM UVÆ URSI.

A tonic astringent, chiefly used in vesical complaints.

## INFUSUM VALERIANÆ.

Occasionally used as the basis of antispasmodic mixtures. Combined with sal-ammoniac and tincture of assafoetida a good “mistura diabolica” is obtained for the treatment of hospital malingerers.

## INJECTIO MORPHIÆ HYPODERMICA.

*Preparation.*—Precipitate morphia by adding ammonia to solution of hydrochlorate of morphia, and redissolve the precipitated alkaloid in acetic acid until a very slightly acid solution is formed.

*Characters and Tests.*—It is almost impossible to obtain a clear solution of acetate of morphia without employing a slight excess of the acid, and even this solution does not keep well. It becomes brown, mouldy, deposits a sediment, and deteriorates in strength, partly from consumption of the alkaloid by the fungoid growth, and partly by precipitation of pure morphia (Maisch) on the filaments of the fungus. A solution of hydrochlorate of morphia keeps much better; especially when made with the pure salt, and with camphor water.

In all cases hypodermic solutions should if possible be perfectly neutral. The operation of introducing them is performed with the aid of a small graduated syringe, furnished with a needle-canula, the point of which must be pushed fairly through the skin into the subcutaneous tissue, as otherwise the injection will be obstructed and attended with considerable pain.

The advantages of the hypodermic method are:—

(a.) Rapidity of action. The anodyne and hypnotic effects of atropia and morphia are often unmistakeably shown within a few minutes.

(b.) Intensity of effect. Remedies given by this channel are equivalent to twice or thrice the same dose administered by the mouth.

(c.) Economy of material. This is a matter of some importance with very costly drugs, e. g. apomorphia.

(d.) Certainty of action. Absorption is more surely effected than it is from the stomach.

(e.) Facility of introduction in certain cases, when the ordinary channels are not available, e. g. in tetanus, coma, &c.

(f.) The avoidance with some drugs, of unpleasant symptoms, such as local irritation of the stomach.

In the great majority of cases the locality to be selected for the injection is a matter of indifference; the outer aspect of the arm below the insertion of the deltoid, or the gluteal region, furnish suitable spots for this purpose. Avoid entering a vein.

In the case of morphia it should be borne in mind, that the constant repetition of the injections may in some cases create an artificial want, and lay the foundation of a pernicious habit corresponding to that of opium eating.

## IODUM.\*

$$I = 127.$$

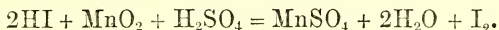
*Origin.*—Iodine is a heavy, black, elementary body, discovered in 1811 by Courtois, a soda manufacturer of Paris. It is found (a) in the animal kingdom, in sponge, cod liver oil, the mollusca, &c.; (b) in the mineral kingdom, in sea water, certain salt springs, and a few minerals; (c) in largest quantity, in the vegetable kingdom, especially in the deep water Laminarian seaweeds, in which it occurs as iodides of potassium, sodium, and magnesium, to the extent of 0·04 to 0·17%. It has also been detected in fresh water plants, e. g. water cress, and even in the cereal grains, and in potatoes, beans, and peas.

*Preparation.*—The seaweeds are burned, and yield a dark coloured fused mass called *kelp*. The soluble salts, iodides, &c.,

\* *Ιον*, a violet; and *εἶδος*, appearance.



are extracted from the kelp by water, the solution is concentrated, and the resulting liquor is treated with sulphuric acid, which forms hydriodic acid, and then is distilled with black oxide of manganese. Free iodine volatilises, and is condensed in suitable receivers—



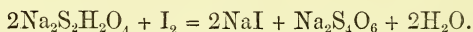
By a similar process chlorine or bromine may be obtained from any chloride or bromide.

*Characters and Tests.*—The heavy, black, glistening scales are easily known by their peculiar, irritating, pungent odour, and by producing a temporary yellow or brown stain on the skin, or on paper. Iodine is very volatile, and when heated to nearly  $400^\circ$ , it rises in a rich purple vapour, whence its name. Its sp. gr. as a solid is 4.9, as a vapour 8.7. It requires 7000 times its weight of water to dissolve it, and then forms a light yellow solution. Alcohol (Tinct. Iodi), ether, benzine, and chloroform, take it up readily, as also an aqueous solution of salt, or of iodide of potassium (Liquor Iodi) which is the best solvent. The stronger aqueous and spirituous solutions are dark red brown and opaque, the chloroform solution is pink. The most delicate *qualitative test* for iodine is starch, which produces with it a deep blue colour, first noticed by Colin and Gualtier de Claubry. The iodine must be in the free state, and the solutions cold, for heat bleaches the iodide of starch. An excess of iodine causes a black colour. Starch paste will detect one part of iodine in 450,000 of water. If the iodine be in combination, e. g. KI, or in an animal fluid, e. g. urine, a drop or two of chlorine solution, or of nitric acid, must first be added to liberate the iodine.

*Adulterations and Impurities.*—Water, sometimes from 15 to 20%, recognised by blotting-paper, and by the iodine adhering to the inside of the bottle; fixed impurities, e. g. coal, black lead, lime, oxide of manganese, remain behind on sublimation; and

iodide of cyanogen,  $\text{CyI}$ , a poisonous substance derived from the nitrogenous matters of the small marine animals in the kelp, would appear at once as a sublimate of pungent, white acicular prisms, by applying a gentle heat. Commercial iodine almost always contains a little chlorine.

The *quantitative estimation* of free iodine is effected by ascertaining how much of a standard solution of hyposulphite of sodium is requisite to decolorise the red iodine solution. Two colourless salts, iodide and tetrathionate of sodium are produced :—



Chlorine and bromine react similarly with the hyposulphite; but the exact separation of  $\text{Cl}$ ,  $\text{Br}$ , and  $\text{I}$  is not an easy matter. Now, since the volumetric hyposulphite solution contains in 1000 gr. measures,  $\frac{1}{10}$  of a molecule for convenience (24·8 grs.), this will correspond to  $\frac{1}{10}$  of an atom of iodine (12·7 grs.) This method is also applied to the indirect estimation of chlorine. (See *Calx Chlorata* and *Liq. Chlori*.)

*Chemical Relations*.—Iodine is a monad, and in all its properties it stands closely related to chlorine and bromine, as shown in the subjoined table of *halogens*, as these bodies are termed, by which it will be seen that bromine is intermediate in properties between chlorine and iodine :—

	Chlorine.	Bromine.	Iodine.
Physical state, .	Gr <sup>e</sup> enish yellow gas.	Orange red liquid.	Dark solid; violet vapour.
Atomic weight, .	35·5	80	1·27
Specific gravity,	2·47	3	4·9

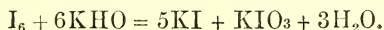
Chlorides, bromides, and iodides usually crystallise in the same form, and their acid compounds with hydrogen ( $\text{HCl}$ ,  $\text{HBr}$ ,  $\text{HI}$ ) are strikingly analogous.

It is remarkable that iodine has a stronger affinity for oxygen

than chlorine or bromine, and a weaker affinity for all other elements, e. g. Cl will displace I from its metallic combinations (KI), whereas I will displace Cl from chlorate of potassium (KClO<sub>3</sub>).

*In Pharmacy.*—Iodine occurs *free* in three solutions, viz., Tincture, Liquor, and Liniment, whose relative strengths are as 1 : 2·5 : 5. In the tincture and liniment, there is not sufficient iodide of potassium to prevent partial separation of the iodine on dilution. The volumetric solution of iodine (App. III.), is used in estimating arsenious and sulphurous acids. The Ung. Iodi contains 16 grs. to ʒi. The preparation sold under the erroneous term of “colourless tincture of iodine” contains iodine in combination, and not in the free state.

Caustic alkalies bleach iodine solutions by forming colourless iodide and iodate of the alkali—



Of the officinal iodides, potassic and cadmic iodides are white, ferrous and mercurous iodides are green, mercuric iodide is red, and iodide of sulphur is nearly black.

*In Medicine.*—Iodine was first employed as a remedy by Dr. Coindet, of Geneva, in 1819, in the treatment of bronchocele. Burnt sponge (in 1680), and some brine springs which contain alkaline iodides, were in use for this affection long before iodine was known to chemists.

*Physiological Action.*—In overdoses it acts as an irritant poison, and may even cause fatal collapse, but, in medicinal doses, it seldom produces serious consequences. In small doses its general effect is that of a stimulant, especially to the glandular system, and it is rapidly eliminated from the body. Its presence in the urine can be determined by the starch test a few minutes after the ingestion of a single moderate dose, and it has also been detected in the saliva, milk, sweat, and blood.

Iodine, or iodide of potassium, occasionally gives rise to

symptoms] which collectively are termed *iodism*. The more prominent of these are frontal headache, coryza, tinnitus aurium, gastro-intestinal irritation, and nausea. Diuresis, salivation, and an enlarged and fissured state of the tongue (L. Parker), with ulceration of the mouth, sometimes ensue. A papulo-vesicular eruption (hydroa) now and then comes out, and purpura has also been observed. But on the other hand, in many cases enormous quantities of iodine or of potassic iodide have been swallowed within a short time without deleterious effects. It is doubtful whether atrophy of the mammæ or testes be ever occasioned by the prolonged medicinal use of iodine.

Topically, iodine in strong solution is an active irritant, and will cause vesication. Weaker solutions induce desquamation of the cuticle, often attended by troublesome itching, and the skin is stained yellow or brown. The stains of iodine may be effectually removed by a little rectified spirit, diluted liquor potassæ, solution of iodide of potassium, or by hyposulphite of sodium. When iodine is painted on the skin it partly, and according to some, wholly, finds its way into the system by inhalation of the vapour which arises, and not by cutaneous absorption.

*Therapeutically*, iodine and the alkaline iodides have been recommended in a multitude of diseases and have indeed suffered from over laudation of their virtues. *Internally*, iodine is of most conspicuous use in affections of a scrofulous or syphilitic nature, and in the latter case, more especially in the later or so called tertiary symptoms. Its beneficial effects on syphilitic nodes and ulcers are often most remarkable and indisputable.

Whenever too mercury is inadmissible or unavailing, iodine may be employed with much benefit. (See Potassii Iodidum.)

Early in this century, Dr. Lugol, of Paris, made extensive inquiries into the use of iodine in scrofula, and prescribed weak aqueous solutions of iodine in iodide of potassium (Nos. 1, 2, 3, =  $\frac{3}{4}$  gr., 1 gr., and  $1\frac{1}{4}$  grs., of iodine, respectively, in  $\bar{3}$  viii. o

water), with results so favourable that it is strange how little the administration of free iodine is countenanced now, its place being usurped by the iodides. Potassic iodide is more rapidly eliminated from the system than iodine.

Iodine has also been specially recommended in obstinate skin diseases, in phthisis and chronic bronchitis, tubercular meningitis and peritonitis, as well as in rheumatism, gout, lumbago, sciatica, and in goitre. The average dose of the tincture is 10 m. The stimulating properties of Vapor Iodi are often utilised in phthisis, chronic bronchitis, and in diphtheria. Iodine has been proposed as a deodoriser, and air charged with organic impurities is rendered entirely inodorous by the volatilisation of iodine in the apartment.

*Externally.*—The tincture or liniment, or a mixture of both, and the ointment, are much employed for the resolution of enlarged lymphatic glands, serofulous abscesses, goitre, ulcers, erysipelas, onychia, chilblains, &c. With a view to disperse an inflammatory exudation, Mr. F. Jordan recommends that the counter-irritant be painted, not directly over the seat of inflammation, but over the nearest vascular region, e. g. along the femoral artery in cases of bubo. In uterine affections the local application of iodine to the cervix uteri, in membranous dysmenorrhœa, chronic inflammation, &c., is highly spoken of. Dr. Greenhalgh advocates the use of “iodised cotton.” The tincture injected into the sac of a hydrocele is a favourite method of cure, and similar injections have been practised with success on other serous cavities, the pleura and the pericardium. Tincture of iodine will cure simple ringworm of the body, and a stronger solution is serviceable in ringworm of the scalp, and in lupus. Coster’s paint for ringworm consists of 3ij. of iodine dissolved in 3i. of oil of tar. The local application of iodine will often relieve the stinging pains in the chest from phthisis; but the protracted use of iodine externally in chronic pleural effusion, or consolidation

of the lung is not followed by so much benefit as might be expected from its repeated recommendation.

### *IODIFORMUM.* (Not Officinal.)

A yellow crystalline substance,  $\text{CHI}_3$ , with a mild taste and odour of saffron. It contains 90% by weight of iodine, and is sometimes employed not only for glandular enlargements, but also, owing to its anæsthetic properties, in skin diseases accompanied with intense itching. It exercises upon the sphincters a local anæsthetic effect so powerful that defecation is sometimes performed unconsciously after its use; it therefore forms the basis of an admirable suppository (three grs. each) in cases of tenesmus, hemorrhoids, and fissures of the anus.

### *IPECACUANHA.\**

*Origin.*—Much uncertainty prevailed for a long time on the botanical origin of ipecacuanha (hippo) root, but it is now satisfactorily referred to the *Cephælis Ipecacuanha*, N. O. Rubiaceæ (Cinchonaceæ). The plant is a small shrub, a native of Brazil, flourishing in moist, dense shady woods, and the roots, when collected by the Indians, are hung up in bundles to dry in the sun.

*Characters.*—The root is easily distinguished by the close set, unequal, circular rings on its surface, which give rise to the term annulated ipecacuanha. The pieces are somewhat like fragments of the young twigs of laburnum. The colour of the exterior is brown, red, or grey, the first being most esteemed, and the central woody portion (meditullium) of the root, which constitutes about  $\frac{1}{3}$  part, is almost inert. The colour of the powder is a light greyish yellow, and Dr. Paris states that its peculiar,

\* Origin of name doubtful, except that it appears to be a native term.



nauseous taste is completely covered by the addition of powdered gum arabic.

The chief constituent of the root is from  $\frac{1}{4}$  to  $\frac{1}{3}\%$  of an alkaloid termed *emetia*, or *emetin*,  $C_{30}H_{44}N_2O_8$ , which is found almost exclusively in the cortical portion, and occurs in combination with ipecacuanhic acid.

Nitrate of emetia is remarkable for its very sparing solubility in water. Pure emetia is a white, uncrystallisable, odourless powder, of bitter pungent taste, and is not to be confounded with the preparation sold in France as *brown* or *medicinal emetin*, which is only an impure extract, analogous to Bonjean's ergotin. Emetin is locally irritant, but there is no good special test for it.

Besides the genuine annulated ipecacuanha, other roots, possessing emetic qualities, have been imported and confounded with the true root. The most important of these are, (1) Peruvian or black striated ipecacuanha, derived from *Psychotria emetica*, N. O. Rubiaceæ, of a dark colour and wrinkled longitudinally: it contains less emetin; (2) undulated, white, or amylaceous ipecacuanha, derived from various species of *Richardsonia*, N. O. Rubiaceæ, light grey externally, and having the surface irregularly indented; (3) false white Brazilian ipecacuanha, derived from different species of *Ionidium*, N. O. Violaceæ, of a light yellowish grey colour, and with a thin cortical portion.

*In Medicine.*—In large doses ipecacuanha is a safe and efficient emetic, not astringent, nor so speedy as the metallic sulphates or mustard, and not liable to cause severe nausea and purging, like tartar emetic. In smaller doses it is diaphoretic and expectorant, promoting the secretions of mucous membranes in a remarkable manner, and hence is valuable in many cases of scanty and viscid secretions, e. g. in whooping-cough, pneumonia, and the coughs of childhood, and also in atonic dyspepsia, and functional derangement of the liver. In very small doses it is a gentle stimulant to the stomach, and is frequently found

useful in checking the vomiting of pregnancy, and of children; but it is difficult to believe in the very minute doses (one drop of the wine three times a day) recommended by Dr. Ringer.

It is remarkable that some persons cannot tolerate ipecacuanha in any form, and even the smell of the powdered root produces in them a distressing sense of suffocation, and a sort of catarrhal asthma.

In cases of recurrent hemoptysis it is highly spoken of by Trousseau and others, and it is also used in the treatment of other forms of hemorrhage. As a diaphoretic it is greatly aided by combination with opium, as in the well known Dover's powder (Pulv. Ipecac. Co.), and the Pil. Ipecac. cum Scilla furnishes an eligible form for a sedative expectorant pill. In bronchitis, the Lozenges of ipecacuanha ( $\frac{1}{4}$  gr. in each), or of ipecacuanha and morphia may be used with advantage, but with caution in the latter form.

As an emetic it is the most generally serviceable of its class, and is highly to be recommended in cases of catarrhal bronchitis, hooping-cough, and croup in children, and, in fact, wherever it is desirable to evacuate the stomach. An excellent combination for an adult, is  $\mathfrak{z}$ ij. or  $\mathfrak{z}$ ijj. of Vin. Ipecac., with 10 to 15 grs. of sulphate of zinc, in  $\mathfrak{z}$ ij. of fluid. A good mode of administering it, especially in the case of children, is to give  $\mathfrak{z}$ ss. to  $\mathfrak{z}$ i. of the wine every ten minutes until vomiting occurs.

The value of ipecacuanha freely given (as practised by Piso in 1658) in cases of dysentery (*radix antidysenterica*) has now been established by numerous competent observers, and it certainly seems to possess peculiar powers over this and allied affections; twenty-five to thirty grs. should be given at a dose, to be reduced as the disease abates. Piso styled it the "sacred anchor" in bowel complaints. (Stillé).

Locally, ipecacuanha is an irritant, and an ointment of it rubbed in, produces a crop of small vesicles or pustules, unattended with

pain, and which leave no scars. In these respects it has advantages over tartar emetic.

Emetia, dose  $\frac{1}{8}$  to  $\frac{1}{2}$  gr., has been used instead of the crude drug, and may be injected hypodermically, but the officinal forms afford sufficiently good modes of administration.

### JALAPA.\*

*Origin.*—The Jalap plant, *Exogonium Purga*, N. O. Convolvulaceæ, is a handsome twining plant with large purple funnel shaped flowers, which grows in its native place, Mexico, at the height of about 6,000 feet above the ocean. Commonly known as Vera Cruz jalap.

*Characters.*—The tuberous roots (not stem-tubers, as in the potato) of jalap vary widely in size, but are usually much smaller than the fist, and are often marked with incisions made to facilitate their drying. Jalap of good quality is heavy, compact, hard, dark brown externally, and presents on section a glistening resinous appearance and numerous concentric circles, which are denser and darker than the intervening portions. Inferior jalap is light, spongy, and white internally, and should then be rejected. The common statement that “worm eaten” jalap is the most active, from the resin being left untouched, is not supported by Mr. Haselden’s experiments. The powdered root is light brown, has a heavy sickly odour, and when inhaled provokes sneezing and coughing. The taste is sweet and rather disagreeable.

The main constituent of the root is a resin (see next article) which forms about 9 to 12% of it, and the active properties of the drug are completely extracted by diluted alcohol (e. g. Tr. Jalapæ).

A specimen of jalap, grown in the Botanic Gardens, T. C. D.,

\* From the town of Xalapa in Vera Cruz.

yielded to me on analysis, 11.97% of greenish yellow resin, which possessed active purgative qualities.—*Pharm. Journ.*, Feb., 1869.

Various adulterations and substitutions have from time to time been practised on jalap. The chief of these are, *Mechoacan*, a Mexican root, from *Asclepias contrayerva*; *Fusiform* or male jalap, from *Convolvulus* (*Ipomæa*) *Orizabensis*; *False rose-scented* jalap of Guibourt; *Tampico* jalap, from *Ipomæa simulans*, &c. But the true jalap is readily distinguished by its own characters. Moreover, the resin of fusiform jalap consists mainly of the glucoside *jalapin* (Kayser's *pararhodeoretin*),  $C_{34}H_{56}O_{16}$ , which is identical with *scammonin*, and is soluble in ether. The substitution is not of much importance since the action of convolvulin (from true jalap) and of jalapin on the body is essentially the same. The root of *Aconitum ferox* has been mistaken for that of jalap with fatal results.

*In Medicine.*—Jalap is an active and excellent hydragogue cathartic, rather apt to gripe, especially when the resin alone is given. The purgative action of jalap (i. e. of convolvulin) is local, and does not follow on the intra-venous or subcutaneous injection of convolvulin. It occurs only when the resin (i. e. convolvulin) comes into direct contact with bile in the intestine, and purgation will not be effected by it after ligature of the bile duct or the establishment of a biliary fistula. The bile simply dissolves convolvulin without decomposing it.

Jalap closely resembles scammony in its action, and is considered to hold a middle place as a purgative between gamboge and senna.

It is most frequently used either simply as a brisk purgative and vermifuge, often conjoined with calomel, ten grs. of each, or, more generally, for its hydragogue qualities, in the treatment of dropsy, (*panacea hydropicorum*). It is seldom prescribed by itself, and the most favourite combinations are, (*a*) with cream of tartar (Pulv. Jal. Co.), and (*b*) with scammony (Pulv. Scamm.

Co.), each of which contain nearly the same quantity of jalap, viz., one in three.

The dose of the extract is from five to ten grs., and of the tincture ʒss.-ʒi.

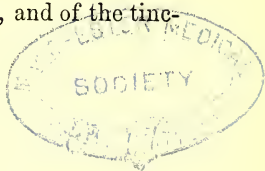
### JALAPÆ RESINA.

*Preparation.*—This, like the other purgative resins, podophyllum and scammony resin, is obtained by (1) exhausting the drug with rectified spirit which extracts the purgative resin; and (2) precipitating the resin by adding water to the concentrated alcoholic solution.

*Characters and Tests.*—Although as usually met with, jalap resin is in brown fragments or powder, it can be obtained as white as starch by filtration through animal charcoal, and this bleached resin is known in commerce by the misleading term of *jalapine*. The resin consists of two portions; one hard, and insoluble in ether, and which forms about  $\frac{7}{10}$  of the whole; the other, soft, and soluble in ether, and which constitutes the remaining  $\frac{3}{10}$ . The portion insoluble in ether is *convolvulin* (Buchner's *jalapin*, Kayser's *rhodeoretin*)  $C_{31}H_{50}O_{16}$ . It is a white, brittle, feebly acid glucoside, and is the active drastic constituent of jalap. The portion soluble in ether is a soft, strongly acid resin, called *jalapin* (*jalapic acid*)  $C_{34}H_{56}O_{16}$ . This sparing solubility in ether distinguishes true jalap resin from the resins of scammony and of fusiform jalap. Unlike scammony resin, it is not readily miscible with milk. From common pine resin it differs in being insoluble in oil of turpentine; and guaiacum resin would be easily detected in it by the fine blue colour the tincture assumes with oxidising agents, e. g. chromic acid. (See Guaiacum.)

*In Pharmacy.*—Forms about one part in five of Pil. Scamm. Co.

*In Medicine.*—See Jalapa.



## KAMALA.

*Origin.*—The *Rottlera*\* *tinctoria*,† N. O. Euphorbiaceæ, is a small tree, which grows throughout Hindostan, and bears a fruit about the size of a pea or small cherry, which is thickly covered with a red powder, the Kamala of commerce. The capsules are gathered in spring, and the powder carefully brushed from them. Thus we have two resinous glandular powders derived from fruits; a *yellow* one, lupulin, and a *red* one, kamala.

*Characters.*—Easily distinguished, for it is the only officinal brick red vegetable powder, and closely resembles fine red sand, or lithic acid gravel. It is inflammable, and flashes like gunpowder or lycopodium when sprinkled into the flame of a candle. The particles feel gritty under the teeth owing to the presence of a considerable quantity of silica. Kamala is mainly, nearly 80% composed of a yellow resin (rottlerin), soluble in alcohol and ether, and of a red colouring matter. Under the microscope it is seen to consist of garnet red rounded grains (glands), composed of club shaped cells,  $\frac{1}{300}$  to  $\frac{1}{250}$  inch in diameter, mixed with minute stellate (siliceous?) hairs. A reddish black kamala is described by Flückiger, with hairs and glands of a different form, apparently derived from a species of *Mallotus*.

*In Medicine.*—In full doses kamala is an active purgative, and has long been used in India in the treatment of tapeworm. Its vermifuge powers are well attested, and it usually expels the worm dead at the third or fourth stool. But its bulky dose and costliness stand in the way of its general adoption, and in these countries its place is usually taken by the extract of male fern which proves very efficacious.

Kamala must be given in large doses, 3ss. to 3iv. and may be suspended in water, mucilage, or syrup. A tincture has also

\* Named after Dr. Rottler, a Danish missionary.

† Because extensively employed as a dyestuff in India.



been prescribed; and, externally, the drug has been used in scabies and ringworm.

### KINO.\*

*Origin.*—The term *kino* was formerly applied to various and distinct astringent vegetable extracts, and much uncertainty and confusion have enveloped the botanical and geographical history of the drug. Thus, we have West India (Jamaica) kino (*Coccoloba uvifera*); South American kino; Butea gum; African kino (*Pterocarpus erinaceus*); Botany Bay kino (*Eucalyptus*), &c., but the only kino recognised in the Pharmacopœia is the East India or Amboyna kino, derived from *Pterocarpus Marsupium*, N. O. Leguminosæ. Longitudinal incisions are made in the bark of the tree, and the juice, on drying, breaks into small fragments, and is then put into boxes for exportation.

*Characters.*—Distinguished at once by the small angular glistening fragments, which resemble some specimens of tartarised iron. It burns with little flame, and is soluble in water and also in spirit (Tinct. Kino). The tincture, when long kept, often solidifies into a black jelly, and loses its astringency. Alkalies render kino more soluble in water, but destroy its astringency. It consists mainly of 75% of tannin or some modification of tannic acid, and its solutions precipitate iron salts of a green colour.

*In Medicine.*—Kino ranks as a simple powerful astringent, and is often used to check morbid discharges, e. g. diarrhœa and dysentery, and in passive hemorrhages.

It is more usually combined with other vegetable astringents, e. g. Pulv. Catechu Co., or with opium, e. g. Pulv. Kino Co., and in its general effects corresponds with catechu and rhatany.

Powdered kino is occasionally employed externally to check hemorrhage, and as an application to indolent and flabby ulcers,

\* Origin of name not known; probably an Indian term.

and the tincture is often added to astringent mixtures for internal use. The infusion would be a preferable preparation.

### KRAMERIÆ RADIX.

*Origin.*—Rhatany is the dried root of a Peruvian shrub, *Krameria triandra* N. O. Polygalaceæ.

*Characters.*—Peruvian (or Payta) Rhatany is easily recognised, for it is the only red root, and, when peeled, bears some resemblance to logwood. The root has no smell, but possesses a very astringent taste, which is much stronger in the cortical portion, and is owing to the presence of a large amount, 40%, of tannic acid. Krameria-tannic acid gives a dark green precipitate with perchloride of iron. Rhatany also contains an amidic acid, rhatanin,  $C_{10}H_{13}NO_3$ , homologous with tyrosin, which latter body has also been stated to occur in extract of rhatany.

The New Granada or Savanilla rhatany, often substituted for the officinal drug, is the product of *Krameria Ixina*, or *K. tomentosa*. A third elastic variety, termed Para rhatany, is found in commerce, but its origin is unknown.

The astringent virtues of rhatany are completely extracted by cold water (Extr. *Krameriaë*) and by spirit (Tinct. *Krameriaë*). The infusion, when made with boiling water, becomes turbid on cooling, and a decoction would be still more ineligible.

*In Medicine.*—As a tonic astringent it may be used for the same purposes as catechu and kino, and has long been in use in Peru. Locally it has been highly recommended in fissure of the anus, prolapsus ani, and leucorrhœa. The Infus., dose  $\bar{z}i.$ , the Tinct., dose 3 ss. to 3 i., are the preparations most frequently used.

### LAC.

*Origin.*—Milk is an emulsion secreted by the mammary glands of the female mammalia, and in the subjoined table the average composition of human and of cow's milk is given.

*Characters.*—Under the microscope milk is seen to consist of minute fatty globules (butter), contained in a delicate albuminous envelope, and floating in a transparent medium. The solid constituents of milk are, casein, which when coagulated by acids, or by rennet forms “curds;” lactose (*Saccharum Lactis*), a non-fermenting sugar; fat or butter; and inorganic salts, chlorides, phosphates, &c.

In 1000 parts the average proportion is:—

	Sp. Gr.	Water.	Casein and Extractive.	Sugar.	Butter.	Salts.
Human . .	1·030	887	40	44	27	2
Cow . . . .	1·93	864	55	38	36	7

Good cow's milk affords from 11 to 13% by volume of cream, and 3 to 3½% of butter; but sp. gr. alone, taken by a lactometer or other instrument, is of little value as an index of the quality of the milk.

*In Pharmacy.*—Used in the preparation of *Mistura Scammonii* (4 grs. resin of scammony to 2 oz. milk); and fresh milk is also a good solvent for camphor, of which it dissolves  $\frac{1}{8}$  of its weight.

*In Medicine.*—*Externally.*—In the form of bread and milk poultice, it is often used as an emollient and soothing application, and milk mixed with warm water and a little glycerin, in irritative conditions of the skin, e. g. in acne, pityriasis, &c.

*Internally.*—Besides its familiar use as an article of food, especially in the early years of life, it is therapeutically useful in chronic Bright's disease, and in diabetes mellitus.

Skimmed milk has been specially recommended in diabetes, &c. Milk is of some use as an antidote to corrosive sublimate, and

sulphate of copper, by forming with these poisons sparingly soluble compounds.

In the steppes of Russia a piquant and fragrant intoxicating drink, called *Koumiss*, which is prepared by the fermentation of mare's milk, is extensively in use. It can also be prepared from cow's milk, and has lately been recommended in phthisis and debilitating diseases.

### LACTUCA.

*Origin.*—The term *lactucarium* has been applied to the concrete juice of *Lactuca sativa*, the common garden salad, and of *L. virosa*, the strong-scented lettuce, but the latter alone is now officinal. They belong to the N. O. Compositæ, and both, especially the latter species, contain a white milky juice, which, on exposure, solidifies into a brown mass, somewhat like opium in colour and odour. Hence it has been called “lettuce opium” (Coxe). Lettuce does not contain morphia nor any of the peculiar constituents of opium, and its two bitter principles are *lactucin*, and *lactuco-pierin*.

*In Medicine.*—Lactucarium was introduced some years ago as a substitute for opium, with the asserted advantages of not causing the digestive and nervous disturbances so apt to follow after opium. But although it certainly seems to possess feeble sedative and narcotic qualities, it is uncertain in its action, and its real value is probably very small.

The dose of the extract is from five to ten grs.

### LARICIS CORTEX.

*Origin.*—The inner bark of the common Larch, *Larix Europæa*, N. O. Coniferæ.

It was introduced to the notice of the profession, by Dr. C. Frizel, of Dublin in 1858.

*Characters.*—In quills, or flat pieces, with little taste or odour. Outer surface dark red and uneven, inner surface smooth, and yellow or light red.

It contains resin and tannic acid.

*In Medicine.*—An astringent and stimulant, specially influencing the mucous membranes. Internally, the tincture is recommended to check profuse expectoration in cases of chronic bronchitis; and, in hemorrhagic affections, e.g. purpura. Larch soap has also been used as a local remedy in psoriasis and chronic eczema. Orenburgh gum and Briançon manna are other products of the genus *Larix*.

### LAUROCERASI FOLIA.

*Origin.*—The so called Cherry-laurel, or common Bay, *Prunus Laurocerasus*, N. O. Rosaceæ, is a familiar evergreen in shrubberies and plantations. It is a low tree, with alternate, deep green leaves, small, white, odorous flowers, and a dark fruit not unlike a black cherry in shape and colour. This plant has no relation, except in name, with the true Laurel, or sweet Bay tree (*Laurus nobilis*).

*Characters.*—The leaves are distinguished by their firm leathery consistence, and smooth, shining surface, and especially by emitting a characteristic odour when bruised. The leaves, when recent and entire, have scarcely any smell, but when bruised, or distilled with water, they yield essential oil of bitter almonds and prussic acid. This is probably due to the mutual reaction of the two principles, amygdalin and emulsin, or some analogous bodies, as in the case of the bitter almonds. (See *Amygdala* and *Aqua Laurocerasi*).

*In Medicine.*—See *Aqua Laurocerasi*. Laurel water “possesses no properties which cannot be more safely and certainly obtained from hydrocyanic acid.”

The inner bark of the *Prunus Virginiana*, the wild cherry of

N. America, is extensively used in that country, and has commanded some favour in Europe. It likewise owes its properties to prussic acid, and is an agreeable sedative. Dose of the syrup from  $\mathfrak{z}$ ij. to  $\mathfrak{z}$ iv.

### LIMONIS CORTEX.

*Origin.*—The three fruits known as *citron*, *lemon*, and *lime*, all of which belong to the genus *Citrus*, N. O. *Aurantiaceæ*, closely resemble each other, and the latter two, for all pharmaceutical purposes, may be considered identical.

The yellow exterior rind of the lemon contains a bitter principle, and yields by expression or distillation, a very fragrant essential oil (*Oleum Limonis*), which is contained in innumerable little vesicles on the surface. The white, spongy part of the rind is to be rejected as being devoid of aroma.

The juice of the lemon is acid, its seeds are bitter, and its peel is aromatic.

*In Pharmacy.*—It is the source of *Oleum Limonis*.

*In Medicine.*—Of use only as a flavouring ingredient. The syrup of lemons is an agreeable addition to many prescriptions.

### LIMONIS SUCCUS.

*Origin.*—It is derived from the ripe fruit either of *Citrus Limonum*, or *Citrus Limetta* (lime), N. O. *Aurantiaceæ*.

*Characters.*—Lemon juice is directed to be freshly expressed, for it speedily decomposes by keeping, and becomes unfit for medical use. To preserve the juice, it may be heated to  $150^{\circ}$ , filtered, and set aside in bottles completely filled, or  $\frac{1}{10}$  part of brandy may be added, as in the navy supplies. The most important constituent of the juice is citric acid, which forms about 7% of it, = 32 to 34 grs. to  $\mathfrak{z}$ i., and the best medicinal substitute for lemon juice is a solution of crystallised citric acid



in water, in the above proportion, and flavoured with a little oil of lemon. The proportion of citric acid in lemon juice varies with the age of the fruit. A solution of tartaric acid in water, with the addition of a little sulphuric acid, and flavoured with oil of lemon, has been fraudulently substituted for lemon juice, particularly as an antiscorbutic, but is quite unsuited for that purpose. The fraud would be easily detected by applying the appropriate tests for tartaric and sulphuric acids.

*In Pharmacy.*—It is the source of Acidum Citricum.

*In Medicine.*—The diluted juice in the form of lemonade, or a slice of lemon slowly sucked, is most acceptable in febrile and inflammatory affections. In the prevention and cure of scurvy lemon juice may be considered almost a specific; and ships destined for long voyages should always be provided with a stock of it. Given in large quantities,  $\mathfrak{z}\text{i.}$  to  $\mathfrak{z}\text{iv.}$  every third or fourth hour, it has been much lauded in acute rheumatism. Lime or lemon juice affords a good antidote to poisoning by the caustic alkalies; and either will relieve the hypercatharsis, &c. following an overdose of croton oil.

Topically, lemon-juice has been employed to allay the tormenting itching of pruritus ani et scroti. The Syr. Limonis is often employed as a grateful addition to other drugs.

But lemon juice, or an equivalent solution of citric acid, finds its chief application in the preparation of effervescing saline mixtures with bicarbonate of sodium or potassium, twenty grs. of either of which will neutralise respectively sixteen and fourteen grs. of citric acid. Or,  $\mathfrak{z}\text{ss.}$  of lemon-juice (i. e. 17 grs. citric acid), = carbonate of soda, 35 grs., carbonate of potash, 20 grs., carbonate of ammonia, 15 grs., bicarbonate of soda, 20 grs., bicarbonate of potash, 25 grs. The last makes the most agreeable draught.

An excellent formula for an effervescing mixture is:—

R		R	
Ac. Citrici . .	grs. 140.	Pot. Bicarb. . .	grs. 200.
Syrupi . . .	3 vi.	Tinct. Limonis . .	3 ij.
Aquæ . . .	3 viiiss.	Aquæ . . .	3 viij.
M.		M.	

An equal quantity of each to be mixed and taken while effervescing.

### LINI FARINA.

### LINI SEMINA.

*Origin.*—The common flax, *Linum usitatissimum*, N.O. Linacæ, is an erect, smooth, slender plant, about two feet in height, bearing small, acute, sessile leaves, alternately disposed, and elegant blue funnel-shaped flowers, with all their parts regular, and in fives.

From flax fibres are prepared linen, lint, and tow. The seeds, the oil expressed from them, and the meal of the ground cake are officinal.

*Characters of the Seeds.*—The seeds are easily known by their oval, pointed form, and glossy brown colour. Their outer coat abounds in a mucilaginous matter, which, with hot water, forms a thick viscid fluid. The fixed drying oil (*Oleum Lini*), 20 to 37%, is found in the interior part of the seed. A white flax seed is cultivated in America. When the greater part of the oil is expressed from the seeds, the residue is termed *oil-cake*, and is much used in that state for feeding cattle. Reduced to powder it constitutes *linseed meal*.

*In Pharmacy.*—Linseed meal forms the basis of all the poultices except *Cataplasma Fermenti*.

*In Medicine.*—Flax seed is emollient and demulcent, and flax seed tea (*Infus. Lini*) is often recommended in inflammatory affections of the mucous membrane of the lungs, intestines, and urinary passages; but its efficacy is very doubtful.

The infusion or the decoction may be given as a laxative enema, and the meal when mixed thoroughly with hot water forms the common and useful linseed poultice.

The so called *gum-elastic* bougies, &c., are manufactured of a linen web, coated with successive layers of boiled linseed oil, each allowed to dry by exposure.

### LINIMENTA.

A liniment (*Lino*, to anoint) is an external application intended to be applied by friction. They are always liquid at the temperature of the body.

There are sixteen liniments in the Pharmacopœia, and they all contain either a fixed or a volatile oil, or a soap. The concrete volatile oil, camphor, occurs in three-fourths of the number.

Therapeutically they may be divided into two classes, viz.: sedative or anodyne, and stimulating; the latter subdivision is the more numerous, while under the former head we may reckon *Lin. Aconiti*, *L. Belladonnæ*, *L. Calcis*, *L. Camphoræ* (?), *L. Opii*. The *L. Chloroformi* occupies an intermediate position, being stimulating at first and ultimately anodyne.

### LINIMENTUM ACONITI.

This is simply a very strong tincture of the root, prepared by percolation. Its strength is one in 1, i. e. eight times that of the officinal tincture; or 5i. *Linim.* = 3i. *Tinct.* It is an efficient local application in many cases of neuralgia, painted on the surface; also in rheumatic arthritis.

### LINIMENTUM AMMONIÆ.

*SYN. HARTSHORN AND OIL—VOLATILE LINIMENT.*

The white opaque emulsive appearance of this liniment is owing to the mutual action of the ammonia and oil, a soluble

soap is formed, a soap being the product of the action of a base upon a fat. Olive oil consists mainly of olein (oleate of glycerin), and when mixed with the ammonia an oleate of ammonia is produced and glycerin set free, i. e. it is an emulsion of glycerin and oleate of ammonia. It affords an excellent rubefacient, especially for children.

### LINIMENTUM BELLADONNÆ.

This, like the Linim. Aconiti, is but a strong tincture, and its relative strength to the officinal tincture is as twenty to one, assuming the root and leaves of belladonna to be of equal value, i. e.  $\frac{3}{4}$  i. Linim. = Oi. Tincturæ. It is prepared by percolation similarly to its tincture.

Very valuable in cases of neuralgia; it may be applied by a brush, or by means of lint.

### LINIMENTUM CALCIS.

In this case, as in the Linim. Ammoniæ, a soap is produced; but it (oleate of lime) is insoluble, and as there is a great excess of oil, much of the latter separates on standing. The liniment is an emulsion of glycerin and oleate of lime.

When made with linseed oil it constitutes the well known Carron Oil, so called from having been much employed at the Carron Iron Works, near Stirling. Olive oil has a less unpleasant odour than flaxseed oil.

It is a very useful liniment in recent scalds and burns.

### LINIMENTUM CAMPHORÆ.

#### *SYN. CAMPHORATED OIL.*

This preparation illustrates the solubility of a volatile oil in a fixed oil. It is in common use in sprains, bruises, and rheumatic affections of the joints.

## LINIMENTUM CAMPHORÆ COMPOSITUM.

The strong solution of ammonia increases the rubefacient virtues of the camphor, and its uses are similar to the last.

It is one of the best and safest counter-irritants to use with children, e. g. in cases of bronchitis. This preparation bears some resemblance to Dr. Granville's "counter-irritant lotion," and is in fact little more than a dilution of Liq. Ammon. Fort., which is too powerful for convenient use.

A suitable mode of application in some cases, is to fill the lid of a large pill-box with lint, to saturate this with the liquid, and then press it upon the part.

## LINIMENTUM CHLOROFORMI.

This is an admirable local application in painful affections; but on a sensitive skin, the proportion of chloroform (i. e. one-half) will cause too active irritation. In order to gain its full anodyne effect the chloroform should be protected from evaporation. An excellent combination is obtained by mixing 3 ij. of this liniment with 3 iij. each of Linim. Aconiti and Linim. Bellad. The chloroform promotes the absorption of the alkaloids by the skin.

## LINIMENTUM CROTONIS.

This is an active counter-irritant, small vesicles or even pustules being induced by its use.

The oil of cajuput and rectified spirit are now introduced instead of olive oil, as in the B. P., 1864, in order to increase the stimulating properties of the liniment. Croton oil is also readily miscible with oil of turpentine, and thus forms a powerful irritant.

## LINIMENTUM HYDRARGYRI.

This liniment has been used as a rapid means for introducing mercury into the system, but is more generally employed for the dispersion of chronic arthritic and glandular swellings, and venereal tumours.

A soap is formed by the reaction of the ammonia on the fats.

It is said to affect the mouth more rapidly than strong mercurial ointment, and probably the stimulant influence of the ammonia and camphor would aid absorption of the mercury.

The preparations of the oleate of mercury introduced by Mr. Marshall furnish a more cleanly form of liniment.

## LINIMENTUM IODI.

This is now reduced in strength by one-half, as it was previously too energetic in its action. The iodide of potassium serves to retain the iodine in solution if water be added; but there is not enough present to prevent partial separation. It is five times as strong as the Tincture, and nearly two and three-quarter times as strong as the Liquor Iodi.

If liquor potassæ be added to Linim. Iodi or Tinct. Iodi, the colour is discharged (see Iodum); and owing to the presence of alcohol, a yellow precipitate of iodoform,  $\text{CHI}_3$ , possessing a saffron odour, is formed. This liniment is in common use for application to the chest in pleuritic pains, to enlarged bursæ, swelled joints, &c.

## LINIMENTUM OPII.

It is known commonly as “anodyne liniment,” and may be employed with benefit as an embrocation in sprains and rheumatic pains.



## LINIMENTUM POTASSII IODIDI CUM SAPONE.

This is esteemed by some as a resolvent and stimulant application to swollen glands, &c. ; but the value of the external use of iodide of potassium is doubtful. It did not appear in the Ph. of 1864, and was introduced into use, modified from a German origin, by Dr. Rumsey, of Cheltenham.

## LINIMENTUM SAPONIS.

This preparation, the “camphorated tincture of soap,” nearly represents in composition the older preparation called *Opo-deldoc* (an oriental term), which was, however, made from common curd soap (i. e. prepared with animal fat), and when cold, was of a soft, semi-solid consistence. The basis of this formula was first proposed by Riverius.

The addition of the  $\text{ʒij.}$  of water is necessary, in order to enable the spirit to retain the soap in solution; but this liniment is apt to gelatinise when cooled. The soap liniment is in considerable use as an anodyne and gentle stimulant in sprains, bruises, and rheumatic or gouty pains.

## LINIMENTUM SINAPIS COMPOSITUM.

A powerful topical stimulant and rubefacient. The proportion of oil of mustard is one in 41.

This preparation is not much employed; it is costly, and is quite unnecessary.

## LINIMENTUM TEREBINTHINÆ.

This was prepared with resin ointment in the last edition, B. P., and then represented the liniment originally proposed by Dr. Kentish as a remedy for burns and scalds.

## LINIMENTUM TEREBINTHINÆ ACETICUM.

The rubefacient effect of the turpentine is increased by the addition of the acetic acid. It is the representative of the once famous nostrum, St. John Long's liniment.

## LIQUORES.

With the exception of Liq. Epispasticus, all the "Liquores" are solutions of either inorganic bodies, whether simple (Liq. Chlori, Liq. Iodi), or compound (Liq. Ferri Perchlor.), or of definite vegetable principles, viz., the alkaloids, usually in distilled water.

They number thirty-nine in all, sixteen of which were not in the Ph. of 1864. The Liq. Epispast. is the Linim. Canthar. of 1864, and is the only "solution" derived from the animal kingdom. In respect of composition nearly half (seventeen\*) belong to the alkaline class; five contain vegetable alkaloids; there are four chalybeate; three arsenical solutions; and ten of miscellaneous composition. Five of them are *effervescing*, i. e. contain excess of CO<sub>2</sub> gas under pressure, viz., those of lithia, magnesia, potash, and soda. The most important point to remember in regard to their strength is, that all the poisonous or very active "Liquores," intended for use internally, contain 4 grs. of their respective drug per fluid ounce = gr. ss. to ʒi.—thus:—

Arsenic . . . .	{	Liq. Arsenicalis.
	{	„ Arsenici Hydrochlor.
	{	„ Sodæ Arseniatis.
Atropia . . . .	{	Liq. Atropiæ.
	{	„ „ Sulph.
Morphia . . . .	{	Liq. Morph. Acet.
	{	„ „ Hydrochlor.
Potash . . . .		Liq. Pot. Permang.
Strychnia . . . .		Liq. Strychniæ.

Liq. Hydr. Perchlor. is  $\frac{1}{8}$  the strength of these, viz., gr. ss. to ʒi.

\* Ammonia and soda each yield four; potash and lime three each; magnesia two; and lithia one.

## LIQUOR AMMONIÆ.

10% of ammonia gas.

See p. 94.

## LIQUOR AMMONIÆ ACETATIS.

7% of acetate of ammonia.

See p. 96.

## LIQUOR AMMONIÆ CITRATIS.

15% of citrate of ammonia.

See p. 99.

## LIQUOR AMMONIÆ FORTIOR.

32·5% of ammonia gas.

See p. 94.

## LIQUOR ANTIMONII CHLORIDI.

36·7% of chloride of antimony.

See p. 115.

## LIQUOR ARSENICALIS.

*Preparation.*—Dissolve powdered white arsenic ( $\text{As}_2\text{O}_3$ ) in a solution of carbonate of potassium by the aid of heat, and when cool, colour with tincture of lavender.

Care should be taken that the arsenic employed be free from impurities.

The title by which it is often known, viz., Liq. Pot. Arsenitis, is not correct, for the arsenious acid does not decompose the alkaline carbonate, except after long boiling.

This preparation, commonly called Fowler's solution, was introduced by the late Dr. Fowler, of Stafford, and was intended as a substitute for the "tasteless ague drop."

The tincture of lavender was originally added to give colour, and thus to guard against mistaking it for other colourless solutions.

*Characters and Tests.*—A pink alkaline liquid, with an agreeable odour of lavender. On long keeping it becomes paler, and if preserved in white glass bottles is apt to suffer partial decomposition, and to cause a deposit on the inside of the bottle. The arsenic in it can be entirely precipitated as orpiment ( $\text{As}_2\text{S}_3$ ) by sulphuretted hydrogen, after being acidulated with  $\text{HCl}$ , or acetic acid, because the precipitate is soluble in carbonate of potassium, or any alkali.

The volumetric test has been already explained under *Ac. Arseniosum*.

*In Medicine.*—A convenient mode of giving arsenic internally, and the one that is usually resorted to. The tincture of lavender gives this preparation a slightly mawkish taste, but its addition is quite unnecessary. The action and uses of this solution have been already described under *Acidum Arseniosum*.

### LIQUOR ARSENICI HYDROCHLORICUS.

*Preparation.*—Boil powdered white arsenic with dilute hydrochloric acid.

The liquid is simply a solution of unchanged arsenious acid in hydrochloric acid, for no decomposition occurs. ¶ If white arsenic and strong  $\text{HCl}$  were distilled together, volatile chloride of arsenic would be formed, and this is the basis of Schneider's process for separating arsenic from organic matters.

*Characters and Tests.*—The arsenic in the solution is completely precipitated *at once* by sulphuretted hydrogen, because the solution is already acid (compare *Liq. Arsenicalis*). ¶ The volumetric test is explained under *Acidum Arseniosum*.

The strength is 4 grs. to  $\text{ʒi}$ .

*In Medicine.*—This preparation is sometimes borne better by the stomach than Fowler's solution, and is moreover useful for

combination with other remedies, e. g. salts of iron, which would be precipitated by the alkaline carbonate existing in Liq. Arsenicalis. The dose is the same. What was formerly known as De Valangin's solution was a similar but weaker preparation, containing  $1\frac{1}{2}$  grs. of  $\text{As}_2\text{O}_3$  per ounce.

### LIQUOR ATROPIÆ.

A strong spirituous solution of atropia. May be used internally in doses of two to four m., or hypodermically, but for the latter purpose, or for ophthalmic use, the next solution is preferable on account of the absence of spirit.

### LIQUOR ATROPIÆ SULPHATIS.

An unirritating neutral solution, well adapted for local or hypodermic employment. If made with *pure* camphor water it will remain perfectly clear and colourless for two years, and the solution does not cause pain when injected subcutaneously. For the uses of either of these preparations see Atropia, and Belladonna.

### LIQUOR BISMUTHI ET AMMONIÆ CITRATIS.

The only officinal form for prescribing bismuth in solution. See p. 158.

### LIQUOR CALCIS.

A weak aqueous solution of slaked lime;  $\frac{1}{2}$  gr. to  $\bar{3}$ i.  
See p. 175.

### LIQUOR CALCIS CHLORATÆ.

A simple aqueous solution of bleaching salt of lime. See Calx Chlorata, p. 181.

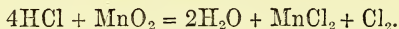
## LIQUOR CALCIS SACCHARATUS.

A solution of saccharate of lime,  $12\frac{1}{2}$  times as strong as lime water (Liq. Calcis). See p. 176.

## LIQUOR CHLORI.

$$\text{Cl} = 35\cdot5.$$

*Preparation.*—Chlorine gas may be obtained from any metallic chloride, e. g. common salt (NaCl), but is usually procured from its hydrogen compound (HCl) by the agency of black oxide of manganese, the oxygen of which combines with the hydrogen of the acid—



The liberated gas is first passed through a wash-bottle, and thence into a receiver containing distilled water. Manganic chloride,  $\text{MnCl}_4$ , is formed when the oxide is mixed with strong hydrochloric acid and kept cold, but on the application of heat, it is broken up into chlorine gas, and manganous chloride,  $\text{MnCl}_2$ , which remains in solution.

*Characters and Tests.*—Chlorine gas possesses a yellowish-green colour ( $\chi\lambda\omega\rho\acute{o}s$ , green),<sup>1</sup> which it communicates to water. The odour of it is peculiarly pungent and suffocating, and care must be taken in experimenting with it. Chlorine gas is nearly  $2\frac{1}{2}$  times as heavy as air, and is readily soluble in water, which at  $60^\circ\text{F}$ . absorbs 2·33 times its volume of the gas, or about 0·75 by weight. By cooling the solution, crystals of hydrate of chlorine can be obtained. Under the influence of light, chlorine slowly decomposes water, with production of hydrochloric acid and oxygen gas, and the solution loses its characteristic properties. It is therefore directed to be preserved in a well-stoppered green glass bottle, in a cool and dark place. Chlorine possesses energetic bleaching qualities, and will at once discharge



the colour of indigo, logwood, vegetable greens, &c., and this property combined with its odour serves as a test for its presence. On account of the volatility of chlorine, its quantitative estimation in solution (chlorimetry) is effected by means of iodide of potassium, as explained under *Calx Chlorata*. Each atom of Cl liberates one atom of I, and this latter is determined by sodium hyposulphite. 1000 gr. measures of hyposulphite solution = 3.55 grs. Cl, therefore in the officinal test, 750 measures = 2.66 grs., = 0.6% by weight.

*In Pharmacy.*—Used to liberate iodine from iodide of potassium, and to test the bromides of ammonium and potassium for iodine; to test for quinia, also to peroxidise iron, previous to its removal from *Zinci Chlor.*, and *Zinci Sulph.* Dry chlorine gas is employed in the preparation of *Chloral*.

*In Medicine.*—The most prominent effects of chlorine are as a stimulant and antiseptic, and its medical properties coincide essentially with those of *Calx Chlorata*, and *Liq. Sodæ Chloratæ*, and to a certain extent with nitro-muriatic acid.

Internally, chlorine water has been especially recommended in typhus fever, scarlatina, and malignant sore throat, in doses of 10 m. to 3 ss., properly diluted. As a gargle or wash, its place is more conveniently taken by *Liq. Calc. Chlor.*, or *Liq. Sodæ Chlor.*

The Vapor Chlori is useful in some cases of chronic bronchitis.

### LIQUOR EPISPASTICUS.

An aceto-ethereal solution of the active matter of cantharides, and a convenient mode of obtaining rapid vesication.

See *Cantharis*, p. 194.

### LIQUOR FERRI PERCHLORIDI.

Corresponds in strength with the *Tinct. Ferri Perchloridi*, and is not liable to decomposition.

See p. 323.

## LIQUOR FERRI PERCHLORIDI FORTIOR.

A concentrated solution of ferric chloride, used only for the preparation of more dilute solutions.

See p. 323.

## LIQUOR FERRI PERNITRATIS.

A useful astringent in chronic diarrhœa.

See p. 325.

## LIQUOR FERRI PERSULPHATIS.

A powerful astringent ; useful as a hæmostatic.

See p. 327.

The relative amount of iron in the three chalybeate "Liquores" is approximately :—

Perchloride.		Pernitrate.		Persulphate.
6	:	1	:	4·4.

## LIQUOR GUTTA-PERCHA.

A solution of gutta-percha in chloroform.

*Preparation.*—If the gutta-percha be of good quality, and thinly cut, the solution is readily effected. The carbonate of lead acts as a mechanical purifier. It unites with the colouring matter, and other impurities ; from its weight, it gradually subsides, carrying these with it, and leaves a clear and nearly colourless solution behind.

*In Pharmacy.*—Introduced as a vehicle for the powder of black mustard seed in preparing the Charta Sinapis.

## LIQUOR HYDRARGYRI NITRATIS ACIDUS.

A caustic applied to sloughing ulcers, &c.

See p. 367.

## LIQUOR HYDRARGYRI PERCHLORIDI.

A useful formula for the internal administration of corrosive sublimate. It keeps well.

See p. 371.

*In Pharmacy.*—Used in testing Ac. Phosph. Dil. for phosphorous acid.

## LIQUOR IODI.

An aqueous solution of iodine, one half the strength of *Limentum Iodi*, and two and a half times as strong as the *Tincture*.

See p. 388.

## LIQUOR LITHIÆ EFFERVESCENS.

*Preparation.*—Lithia water is a solution of 10 grs. of carbonate of lithium in one pint of water ( $= \frac{1}{2}$  gr. to  $\text{ʒi.}$ ), charged with seven times its volume of carbonic acid gas, and kept in bottles securely closed.

*Characters and Tests.*—When the vessel containing the solution is opened  $\frac{6}{7}$  of the gas escapes, one volume remaining dissolved under the ordinary atmospheric pressure.\*

For its uses see *Lithium*, p. 431.

## LIQUOR MAGNESIÆ CARBONATIS.

*Preparation.*—Comprises two stages—(1) Preparation of fresh carbonate of magnesium; (2) Solution of this precipitate in carbonic acid gas.

\* As this is the first of the “effervescing solutions,” it may be remarked in reference to the solubility of gases in water at a given temperature that, whatever be the weight and volume of a gas dissolved by any liquid at ordinary pressure, the volume of gas absorbed will increase directly as the pressure, i. e. under quadruple pressure the liquid will dissolve four times the volume and weight of the gas which it originally absorbed.

Add solution of carbonate of sodium to hot solution of sulphate of magnesium, and boil until complete decomposition is effected. Filter, wash the precipitate of  $\text{MgCO}_3$ , place it in a pint of distilled water, and pass in carbonic acid gas until solution of the carbonate is obtained.

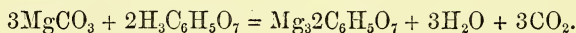
*Characters and Tests.*—The gas not having been forced in under considerable pressure, as in the last preparation, the solution effervesces slightly, or not at all, when the bottle is first opened. The liquid is perfectly clear at first, but deposits after a time crystals of hydrated carbonate of magnesium; if heated, it yields a precipitate of  $\text{MgCO}_3 \cdot 3\text{H}_2\text{O}$ ; exposed to cold, large crystals sometimes form,  $\text{MgCO}_3 \cdot 5\text{H}_2\text{O}$ . The strength of “fluid magnesia” is stated to be 13 grs. of carbonate to  $\text{z}\text{i}$ ., but it is seldom if ever up to this standard, and a solution of 8 or 10 grs. to  $\text{z}\text{i}$ . would be more readily made, and much more easily kept without alteration of strength.

For its uses see *Magnesiae Carbonas*.

### LIQUOR MAGNESIÆ CITRATIS.

An aqueous solution of citrate of magnesia, with excess of citric acid, impregnated with carbonic acid gas, and sweetened with syrup.

*Preparation.*—Dissolve carbonate of magnesium in excess of citric acid, and add, before bottling, some crystals of bicarbonate of potassium—



The object of the addition of the alkaline bicarbonate is to generate carbonic anhydride, so as to render the solution effervescing. Citrate of potassium is thereby also formed in the solution.

This formula is a modification of the process in the French Codex for *purgative lemonade*.

*In Medicine.*—Introduced as a preparation which should really contain citrate of magnesia, since what is commonly sold under that title is a totally different thing. (See Sodæ Citro-Tart. Efferv.) A mild cooling laxative, acceptable to the stomach, and extensively used in the United States. The only objection is the large quantity required for a dose, viz.,  $\bar{3}v.$  to  $\bar{3}x.$

### LIQUOR MORPHIÆ ACETATIS.

#### LIQUOR MORPHIÆ HYDROCHLORATIS.

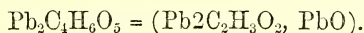
Each of these solutions contains 4 grs. of the morphia salt dissolved by a few minims of their respective acids (2 m. to 1 gr.), with the addition of one fourth part of rectified spirit, to prevent spontaneous decomposition. But after a time, fungi will always form in the solutions. As was remarked under Liq. Atrop., Sulph., pure camphor water is the best solvent.

For uses, &c., see Morphiæ Acetas, Morphiæ Hydrochl., and Opium.

### LIQUOR PLUMBI SUBACETATIS.

#### LIQUOR PLUMBI SUBACETATIS DILUTUS.

*Preparation.*—Boil neutral acetate of lead (sugar of lead), with about  $\frac{2}{3}$  of its weight of oxide of lead (litharge), filter, and keep in stoppered bottles. A basic or sub-acetate of lead is formed, the empirical formula of which is—



*Characters and Tests.*—This solution soon loses its clearness on exposure, for it quickly absorbs carbonic acid gas, and carbonate of lead is precipitated. In fact, the extreme facility with which it is decomposed by a great number of substances is one of its most striking properties, for not only is it incompatible with most metallic compounds on account of the insolubility of the majority of lead salts, but it also yields

precipitates with most vegetable colouring matters, with tannin, and with many animal substances, especially albumen. It forms with gum an opaque white jelly, and this precipitate is not afforded by the acetate. Hence gum will distinguish between a solution of acetate and subacetate of lead. (See *Acaciæ Gummi*.) Sulphate of lead is one of the three insoluble sulphates (Ba, Sr, Pb); accordingly sulphuric acid precipitates acetate of lead, and sets acetic acid free, which is recognised by its odour.

The quantitative estimation of the lead is effected by precipitation with the standard solution of oxalic acid. The strong solution contains 26·8% of subacetate of lead. A term frequently applied to it is *Goulard's Extract*, from its introduction by a French physician of that name in 1770.

*In Pharmacy*.—It forms the chief ingredient of the *Ung. Pl. Subac. Comp.*, a modification of the old *Goulard's cerate*; but it is usually employed in the dilute form.

*In Medicine*.—The dilute solution, 1 in 80, commonly known as *Goulard water*, or “lead lotion,” is much used as an external application in sprains, bruises, burns, blisters, ulcers, &c., to which it proves very grateful, while its astringent qualities are also of service. Its long continued local employment has occasionally given rise to the constitutional effects of lead poisoning, viz., colic and paralysis, and it seems to be one of the most poisonous salts of lead.

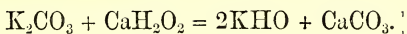
Mixed with “black wash” it forms an admirable dressing for soft chancres, balanitis, and eczematous sores, and if a more stimulant effect be desired in indolent cases, a mixture of equal parts of lead lotion and chlorinated lime solution forms a capital application to sluggish ulcers, &c.

### LIQUOR POTASSÆ.

*Preparation*.—Add slaked lime to boiling solution of carbonate of potassium. Allow the precipitated carbonate of lime to subside,



and transfer the liquid by a siphon or by decantation to a well closed green glass bottle—



Abundance of water is necessary on account of the sparing solubility of lime, neither filtration nor straining can be used because the potash would corrode organic matter, and green glass bottles are directed for storage, because fixed alkalies dissolve the lead contained in white glass, and so become contaminated with that metal.

*Characters and Tests.*—Solution of caustic potash is a colourless liquid of an acrid taste, and powerful alkaline properties. It rapidly corrodes animal and vegetable substances, and feels soapy when rubbed between the fingers, owing to the cuticle being dissolved. It dissolves gum and resin, and forms soluble soaps with oily and fatty bodies, e. g. Sapo Mollis. Albuminous bodies also are readily soluble in it.

The amount of caustic potash in the solution is easily ascertained by adding the standard solution of oxalic acid to one fl. oz., until neutralisation is effected. The solution is ordinarily impure, and is liable to contain, (*a*) carbonate, from imperfect decomposition, or from absorption of  $\text{CO}_2$  from the air; (*b*) lime; (*c*) sulphates; (*d*) chlorides; and (*e*) alumina, a common impurity in the lime. These are tested for respectively, (*a*) by effervescence with an acid, or precipitation with lime water; (*b*) precipitate with oxalate of ammonium; (*c*) precipitate with  $\text{BaCl}_2$ , after neutralisation with nitric acid; (*d*) precipitate with  $\text{AgNO}_3$ , under similar circumstances; and, (*e*) precipitate with  $\text{NH}_3$ , under the same condition.

*In Pharmacy.*—Used in the preparation of Bromide and Iodide of potassium, and of Sapo Mollis. Evaporated to dryness, fused, and poured into moulds solid caustic potash is obtained. Frequently employed as a reagent in chemical operations.

*In Medicine.*—In overdoses, potash acts as a violent irritant

poison, and is best counteracted by mild acids, such as vinegar or lemon juice. On theoretical grounds it has been much recommended and employed in calculous affections as a solvent for urinary calculi, but its efficacy in this respect is extremely doubtful, and it is impossible to give it at all freely on account of its disturbing effect on the stomach.

Externally, more or less diluted, it is often serviceable in the treatment of the indurated and fissured state of the skin that occurs in chronic eczema and psoriasis, and after being well rubbed in for a few moments any excess can be neutralised by a little vinegar.

### LIQUOR POTASSÆ EFFERVESCENS.

*Preparation.*—Potash water is analogous to lithia and soda water, and is a solution of 30 grs. of Potassæ Bicarb. in one pint of water ( $1\frac{1}{2}$  grs. to  $\text{ʒi.}$ ), charged with seven times its volume of carbonic acid gas, and kept in bottles securely closed.

*Characters and Tests.*—When the bottle is opened,  $\frac{6}{7}$  of the gas escapes with effervescence, one volume remaining dissolved under the ordinary atmospheric pressure.

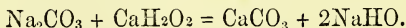
*In Medicine.*—An agreeable form for prescribing an alkali. See Potassæ Bicarbonas.

### LIQUOR POTASSÆ PERMANGANATIS.

A simple aqueous solution of a deep purple colour containing four grs. to  $\text{ʒi.}$  See Potassæ Permanganas.

### LIQUOR SODÆ.

*Preparation.*—The process is precisely similar to that for Liq. Potassæ. Add slaked lime to hot solution of carbonate of sodium—



For the other details, see Liq. Potassæ.

*Characters and Tests.*—The properties and tests of solution of soda being identical with those explained under Liq. Potassæ, the reader is referred to that article. Liquor Sodæ can be readily distinguished from Liquor Potassæ, by *not* yielding precipitates with chloride of platinum or tartaric acid. It contains nearly 19 grs. of caustic soda in  $\bar{3}$ i.

*In Pharmacy.*—Used in the preparation of Antimonium Sulphuratum, of Sodæ Valerianas, Ferri Ox. Magnet., Ferri Perox. Humidum, and Quiniæ Sulphas. The volumetric solution of Soda, App. III., is used in acidimetry. Evaporated to dryness, fused, and poured into moulds, or broken up into fragments, it constitutes solid caustic soda. (Soda Caustica).

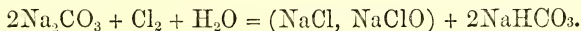
*In Medicine.*—Liq. Sodæ is seldom prescribed internally.

### LIQUOR SODÆ ARSENIATIS.

A simple aqueous solution of anhydrous arseniate of sodium,  $\frac{1}{4}$  grs. to  $\bar{3}$ i. The salt is directed to be dried before solution, because the amount of water of crystallisation in the crystals alters by keeping (from  $12\text{H}_2\text{O}$  to  $7\text{H}_2\text{O}$ ), and thus the solution might be of uncertain strength. At  $300^\circ\text{F}$ . the crystals lose all their water, but the temperature should not pass this limit, lest a portion of the arsenic be volatilised. See Sodæ Arsenias.

### LIQUOR SODÆ CHLORATÆ.

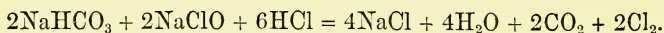
*Preparation.*—Pass washed chlorine gas (generated from  $\text{MnO}_2$  and  $\text{HCl}$ ) into solution of carbonate of sodium—



The chlorine is first passed through water to free it from  $\text{HCl}$ .

*Characters and Tests.*—A colourless liquid possessing bleaching qualities, owing to the facility with which chlorine is given off from it. Since it contains bicarbonate and hypochlorite of

sodium, it effervesces with HCl, and evolves chlorine and carbonic acid gas—



The acid solution is not precipitated by chloride of platinum, showing absence of potash, and its non-precipitation by oxalate of ammonium shows that it contains no lime. It is sometimes prepared with chlorinated lime instead of chlorine gas. The estimation of its chlorine value has been already explained under *Calx Chlorata*.

When the solution is carefully evaporated, a mass of damp crystals is obtained, which, when redissolved in water, reproduce the properties of the original liquid. On exposure to the air, it absorbs carbonic acid, and slowly evolves chlorine.

*In Medicine.*—Chlorinated soda was first brought into notice in 1826, by Labarraque, an apothecary of Paris. It possesses properties similar to those of *Calx Chlorata*, viz., stimulant, antiseptic, and disinfectant. Internally, it has been employed in typhus, malignant scarlatina, in dysenteric affections, and in cases of extreme prostration. As a corrective of fetid evacuations, chlorine preparations are certainly of much benefit. Locally, it may be beneficially employed for similar purposes in gangrenous and other ill-conditioned sores, ulceration of the gums, putrid sore throat, ptyalism, and fetid discharges from the vagina, uterus, and bladder. As a wash or gargle, it may be diluted with three or four parts of water, and the *Cataplasma Sodæ Chlor.* affords a suitable form for application to ulcers.

It is a proper disinfectant for the sick room, and may with advantage be introduced into the vessels intended to receive the excretions.

## LIQUOR SODÆ EFFERVESCENS.

*Preparation.*—Soda water is strictly analogous to lithia or potash water, and is a solution of 30 grs. of bicarbonate of sodium in one pint of water ( $1\frac{1}{2}$  grs. to  $\text{ʒi.}$ ), charged with seven volumes of carbonic acid gas under pressure, and kept in bottles securely closed.

*Characters and Tests.*—As with potash water, when the bottle is opened,  $\frac{6}{7}$  of the gas escapes with effervescence, one volume remaining dissolved under the normal atmospheric pressure.

But since an average bottle of “soda-water” contains only four times the volume of  $\text{CO}_2$  which can exist in it without additional pressure, on drawing the cork three-fourths of the gas will escape.

What is sold as “soda-water,” often contains no soda at all, but is simply a solution of carbonic acid gas in water, an “aerated water,” and any medicinal effect it may possess is due to the sedative action of its carbonic acid.

*In Medicine.*—An agreeable form for prescribing Sodæ Bicarb. See Sodæ Bicarbonas.

## LIQUOR STRYCHNINÆ.

This is an aqueous solution of hydrochlorate of strychnia, 4 grs. to  $\text{ʒi.}$ , containing  $\frac{1}{4}$  part of rectified spirit, which is added for the purpose of preservation.

5 m. =  $\frac{1}{24}$  gr. of strychnia.

For its uses, &c., see Strychnia.

## LIQUOR ZINCI CHLORIDI.

*Preparation.*—The process is identical with that given for Zinci Chloridum under which head it will be explained.

*Characters.*—A colourless caustic solution.

3i. = 45·7 grs.  $\text{ZnCl}_2$  = 366 grs. in 3i.

*In Medicine.*—See Zinci Chloridum.

“Burnett’s disinfecting fluid,” is a solution of  $\text{ZnCl}_2$  not so strong as the officinal solution. Several deaths have occurred from “Burnett’s fluid” being taken, either with suicidal intent, or accidentally, by mistake for “fluid magnesia.”

### LITHIUM.\*

L = 7.

*Source.*—Compounds of lithium, although small in amount compared with those of other elements, are widely diffused in nature, and have been proved by the spectroscope to exist in many soils, waters, springs, in the ashes of numerous plants, and even in milk, and human blood. The principal minerals which yield lithium, are lepidolite, spodumene, and petalite. In these the lithium is associated with potassium or sodium, and with silicate of aluminum. Lithia ( $\text{L}_2\text{O}$ ) was discovered in 1817 by Arfwedson, but the metal, lithium, was not isolated until 1855 by Bunsen and Matthiessen. Lithium is a white, soft, brilliant metal. Sp. gr. 0·594; it is the lightest known solid.

*Chemical Relations.*—Lithium belongs to the class of alkalies, but is distinguished from them, and can be separated analytically by the sparing solubility of its carbonate, and especially its phosphate, and the easy solubility of its platino-chloride. The other salts of lithium are generally freely soluble.

Every lithium compound imparts a magnificent pure crimson colour to flame.

The atom of lithium is monad, or univalent, L', and the

\* *Λίθος*, a stone; from its difficult or slow solubility.



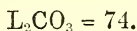
formulae of its chloride, oxide, and carbonate will be then,  $\text{LiCl}$ ,  $\text{Li}_2\text{O}$ , and  $\text{Li}_2\text{CO}_3$ .

Its atomic weight is much the lowest of any of the metals. In many of its properties it is intermediate between the alkaline and alkaline-earthly metals.

*In Medicine.*—Lithia possesses qualities analogous to those of potash and soda, and was introduced into practice in 1843, by Mr. A. Ure, who pointed out the remarkable solvent powers of lithia over uric (lithic) acid, compared with the other alkalies. Hence the urate of sodium with which gouty patients are surcharged is converted into the more soluble urate of lithium, and is so washed out of the system. Strong lithia lotions have been used with success by Garrod and Ringer to disperse gouty swellings. More recently Dr. Garrod has insisted on the great value of lithia salts as diuretics, and in the treatment of gout, and he finds that carbonate of lithium quickly renders the urine neuter or alkaline.

On account of the low atomic weight of lithium, a given weight of a lithia salt will neutralise more acid than an equal weight of the corresponding potash or soda salt. Dr. Garrod states that he has known a very few instances, in which the long continued use of carbonate of lithia has appeared to cause symptoms referrible to the nervous system, as shaking or trembling of one hand, which have disappeared on the omission of the drug.

### LITHIÆ CARBONAS.



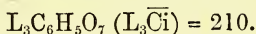
*Preparation.*—May be prepared directly from one of the lithium minerals, or from sulphate or chloride of lithium, by adding carbonate of ammonium.

*Characters and Tests.*—In taste it resembles bicarbonate of soda. Like the other alkaline carbonates it is insoluble in

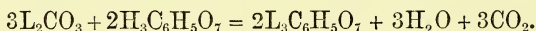
alcohol, but is distinguished by its very slight solubility in cold water. Lime and alumina are precipitated from the sulphuric acid solution by the addition of oxalate of ammonium, and of lime water, respectively. The other characters are explained under Lithium.

*In Medicine.*—The effervescing solution (lithia water) is the most convenient mode of prescribing lithia. Half a pint (i. e. 5 grs. of carbonate) may be taken in the day.

### LITHIÆ CITRAS.



*Preparation.*—Dissolve carbonate of lithium in citric acid, dry carefully, pulverise rapidly, and keep in a stoppered bottle—



*Characters and Tests.*—The citrate is anhydrous, but is deliquescent, and is soluble in 2·5 parts of water. It blackens when heated, and evolves inflammatory gases, evidences of an organic acid. The 51% of white residue left on ignition is carbonate of lithium. The salt is proved to be a citrate by its solution becoming turbid when boiled with lime water, and clearing again on cooling.

*In Medicine.*—Possesses a more agreeable taste than the carbonate, and might perhaps in some cases agree better with the stomach. It is given in somewhat larger doses than the carbonate, into which it is ultimately converted within the system, but it has no primary antacid power.

### LOBELIA\*.

*Origin.*—The Indian tobacco, *Lobelia inflata*, N.O. *Lobeliaceæ*, is a common roadside weed throughout the United

\* Lobel, a celebrated botanist.

States, and as all parts of it are active, the whole plant is directed to be dried. The specific name refers to the fruit, which is an oval, distended capsule, containing numerous small brown seeds.

*Characters.*—The angular hairy stems and inflated fruits characterise the drug. In commerce, it usually occurs in oblong, rectangular compressed cakes, as prepared by the Shaking Quakers of New Lebanon, and somewhat resembles chopped hay. The dried plant has a slightly irritating odour, and when chewed, a tobacco-like taste. It appears to contain, among other matters, a liquid volatile alkaline principle, termed *lobelina*. The seeds include a considerable amount of oily matter, which is extracted in the ethereal tincture. The alkaloid, *lobelina*, is not to be confounded with the impure resinoid substance, termed “lobelin” by the Eclectics of North America.

*In Medicine.*—Lobelia was long in empirical use before it was adopted in regular practice, and we owe its introduction to the Rev. Dr. Cutler, of Massachusetts. From its improper and unguarded use many deaths have occurred, especially in the hands of the quacks appropriately named Coffinites, after their leader; and in large doses it is a dangerous narcotico-acrid poison.

The treatment to be followed in a case of poisoning would be to administer diffusible stimulants, coffee, &c., and to allay gastro-intestinal irritation.

In its general effects, as its popular name implies, it closely resembles tobacco, and though at one time recommended as an emetic (“emetic weed”), it is too powerful, and too nauseating and prostrating to be suitable for such use.

The disease, in the relief of which it has chiefly gained its reputation, is spasmodic asthma, and, in moderate doses, it often greatly mitigates, and sometimes wholly relieves the paroxysms of this distressing disease. It has also been used in croup, whooping-cough, chronic bronchitis, and hay fever.

The dose of either tincture (Tr. Lobel., Tr. Lobel. Æther.,) is 10 to 30 m., repeated every two or three hours, until the desired effect is obtained; but in all cases its action should be watched with care, as some persons are very intolerant of it. Children bear relatively large doses. (Ringer.)

### LOTIO HYDRARGYRI FLAVA.

A lotion ("yellow wash"), containing peroxide of mercury ( $\text{HgO}$ ) in suspension.

Its chemistry and uses have been already described. See Hydr. Oxid. Rubrum.

### LOTIO HYDRARGYRI NIGRA.

A lotion ("black wash"), containing suboxide of mercury ( $\text{Hg}_2\text{O}$ ) in suspension. Its chemistry and uses are described under Hydr. Oxid. Nigrum. It was originally a prescription of Sir Theodore Mayerne, who effected a signal cure by means of it on Sir Kenelm Digby.

### LUPULUS.

*Origin.*—The Hop, *Humulus Lupulus*, N. O. *Urticaceæ*, is a native of North America and Europe, and since it is the product of the *female* plant only which is collected, as in the case of *Cannabis Indica*, it is evident that the sexes are on separate plants, and the hop is therefore diœcious. The male flowers are light yellow, and arranged in loose panicles at the summit of the branches; the female are pale green, and disposed in solitary, stalked membranous cones (strobiles) in the axils of the upper leaves. In the hop fields the seed usually aborts, because the female plant alone is cultivated; but sometimes male flowers

are also produced on the female plants, and suffice to fertilise them.\*

*Characters.*—The oval cones, or strobiles (catkins), consist of numerous thin, translucent, veined scales of a light yellow colour, which conceal near the base two small globular black fruits (achenes). The most active part of hops is a glandular resinous (50% resin) powder, called lupulin (cf. Kamala), which adheres to the base of the inner surface of the scales, but becomes loose as the strobile ripens, and constitutes from  $\frac{1}{10}$  to  $\frac{1}{6}$  of the weight of the strobiles. This lupulin is easily separated by thrashing, rubbing, and sifting the dried cones, and might with advantage be substituted for the hops themselves. Hop cones deprived of the lupulin are almost inert. The peculiar cheesy flavour of old hops is due to the presence of a little valerianic acid, derived from the valerol ( $C_6H_{10}O$ ) of the volatile oil. Hops also contain tannic acid of the variety which precipitates iron salts green.

*In Pharmacy.*—The aroma and astringent bitterness depend on the lupulin, and are extracted by warm water, e. g. Infusum Lupuli. The Tincture contains a considerable amount of resin, and becomes opaque yellow on dilution.

*In Medicine.*—The principal action of hop is that of an aromatic tonic, and in some forms of irritable dyspepsia it suits very well.

In beer and other malt liquors, hop not only adds to their agreeable stomachic qualities, but also assists in preserving them from acetous fermentation. It also possesses some sedative and nar-

\* The hop plant was introduced into England from Flanders in the reign of Henry VIII. :—

“ Hops, reformation, bays, and beer,  
Came into England all in one year.”

Such a prejudice existed against them that the king issued an injunction not to put any hops into the ale.

cotic power, and is frequently used with benefit in the delirium and nervous disturbances of drunkards, and is held by many to be a special sedative to the generative organs. A hop pillow has long been recommended as a means of allaying restlessness, and procuring sleep in nervous disorders; but it probably acts chiefly on the imagination. It is stated to have been successful in the case of George III. The hops should be first moistened with spirit to prevent the rustling noise. The Infusion (dose  $\text{ʒi. to ʒij.}$ ), and the Tinct. (dose  $\text{ʒ ss.}$ ), are the preparations generally employed. A tincture of lupulin was in the Dublin Pharmacopœia of 1850.

### MAGNESIUM.\*

*Origin and Characters.*—The most abundant sources of the compounds of magnesium in nature are, (1) chloride, and sulphate (Epsom salts), in sea water and certain saline springs; (2) carbonate, either tolerably pure, when it is called *magnesite*, or combined with calcic carbonate as a double salt, termed *dolomite* or mountain limestone, a common building material.

Magnesium is a brilliant white metal, resembling silver, but much lighter, sp. gr. 1.74, and fusible at a low temperature. It burns readily in air, producing a white cloud of particles of magnesia ( $\text{MgO}$ ), and emitting a dazzling light due to ignition of the oxide.

The “magnesium light” is now much used in scientific experiments, and has been employed as a source of illumination in the use of the laryngoscope.

*Chemical Relations.*†—The atom of magnesium is dyad, hence its chloride =  $\text{Mg Cl}_2$ , sulphate =  $\text{Mg SO}_4$ , &c. It readily dissolves in dilute acids, disengaging hydrogen. It exhibits a

\* Magnesia, a district of Lydia.

† The tests for magnesia and the usual impurities associated with its compounds will, in order to avoid repetition, be here explained.



marked tendency to form basic oxysalts, e. g. *Magnesiae Carbonas*, analogous to the carbonates of lead, zinc, and bismuth; and with ammoniacal salts, especially sal-ammoniac,  $\text{NH}_4\text{Cl}$ , it forms soluble double salts, so that a magnesian salt cannot be entirely precipitated from its solution by ammonia or its carbonate. If sufficient sal-ammoniac be first added, no precipitation at all will occur.

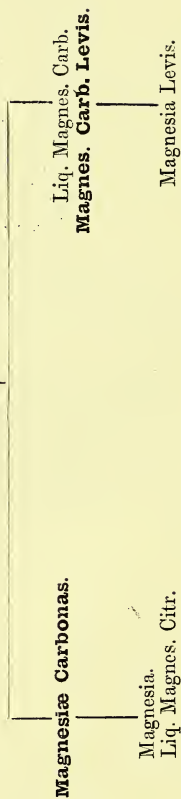
But phosphate of magnesium is insoluble in ammonia or its compounds, and the best *test* for magnesium (in the absence of all other metals except the alkalies) consists in the production of a white crystalline precipitate of ammonio-magnesian phosphate,  $\text{MgNH}_4\text{PO}_4$  (the so called “triple phosphate”), on the addition of phosphate of sodium, together with ammonia and sal-ammoniac, to the magnesian solution. The sal-ammoniac prevents the premature precipitation of part of the magnesia by the free ammonia.

Lime in a magnesian salt is detected by oxalate of ammonium giving a white precipitate, insoluble in acetic acid; sulphates, by chloride of barium; and alumina or iron, by precipitation with sulphuretted hydrogen in the ammoniacal solution. In acid solution, iron would afford a blue precipitate with ferrocyanide of potassium.

GENEALOGICAL TABLE OF THE MAGNESIAN COMPOUNDS.

From **Dolomite** (Magnesian Limestone) is prepared :—

**Magnesiæ Sulphas.**



*In Medicine.*—The chief therapeutic uses of magnesia and its carbonate, i. e. the insoluble compounds, are as antacids and mild laxatives. The sulphate and other soluble salts are safe hydragogue purgatives.

Light magnesia is also recommended as an antidote to poisoning by oxalic and the mineral acids, and phosphorus. With arsenious oxide it forms an insoluble and inert compound. (Bussy.)

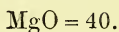
Magnesia and its carbonate are a good deal in favour as aperients for children and delicate persons, and “fluid magnesia” is an advantageous form for exhibition. All the soluble salts of magnesium are more or less bitter.

In dyspepsia, sick headache, acid diarrhœa, gouty and calculous affections, magnesia and its carbonate are much esteemed; and in colic and constipation the sulphate is frequently employed.

The advantages of magnesia or its carbonate over other antacids (such as soda or lime) are, (1) their large saturating capacity for acid; (2) their purgative property; (3) when given in excess they do no harm on account of their insolubility; (4) their insipidity. The only possible danger, which has very rarely happened, is the risk of their accumulating in the bowels and forming intestinal concretions. Two pints of magnesian sand have been evacuated from the intestines of a woman (Gubler), and many pounds of carbonate of magnesia have been collected after death, in the colon, above a contracted part of the rectum (Sir B. Brodie). This untoward result may partly arise from a deficiency of acids in the intestinal canal. Acidulous drinks, such as lemonade, are appropriately administered after magnesia or its carbonate.

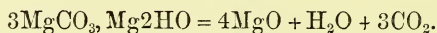
## MAGNESIA.\*

## MAGNESIA LEVIS.



Magnesia was first distinguished from lime by Dr. Black, in 1755.

*Preparation.*—There are two forms of magnesia in the Pharmacopœia, a heavier and a lighter powder, identical in composition, and differing only in the state of aggregation of their particles. The heavy magnesia is smoother and more easily suspended in water. They are obtained by heating their respective carbonates until all the  $\text{CO}_2$  is given off, as shown by the powder not effervescing when dropped into diluted sulphuric acid—



*Characters and Tests.*—Either variety of magnesia is commonly known as “calcined magnesia,” and there is no advantage gained by retaining two forms of the oxide and two of the carbonate. Though the sp. gr. of the oxide is 2.3, yet the light  $\text{MgO}$  is so bulky that a four oz. bottle holds only about one oz. by weight of the finest  $\text{MgO}$ . A given weight of “light magnesia” occupies  $3\frac{1}{2}$  times the bulk of the same weight of heavy magnesia. It is quite infusible, and almost insoluble in water, yet a little moistened  $\text{MgO}$  placed on a piece of red litmus paper slowly turns it blue. Like lime, it is more soluble in *cold* than hot water, for it requires over 5000 parts of water at  $60^\circ$ , and 36,000 parts of boiling water for solution. Water poured on it is absorbed to the extent of about 18%, but without sensible increase

\* Magnesia was originally a general term expressive of any substance which had the power of attracting some principle from the air; from *Magnes*, the loadstone (Paris).

of temperature. Magnesia is easily distinguishable from the other alkaline earths by forming a soluble and bitter sulphate. The other tests have been already explained.

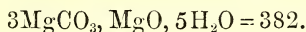
*In Pharmacy.*—It is sometimes employed to make a bolus with copaiba, which it solidifies. An ounce of copaiba triturated with 3 ss. of magnesia gradually becomes solid. In mixtures, if prescribed with only a moderate amount of water, it is apt to form a more or less concrete mass, owing to the formation of a hydrate of magnesia.

*In Medicine.*—Magnesia is a mild and tasteless antacid and slow purgative, and has the advantage over the carbonate that it may be given in a smaller dose, and does not occasion flatulence. It may be suitably administered in milk. Gregory's powder (Pulv. Rhei Co.) is a universal favourite as an antacid laxative in children's complaints; dose for a child, five to ten grs.

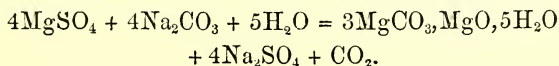
Henry's calcined magnesia is a particularly pure and dense form of the oxide. It does not so readily combine with acids.

### MAGNESIÆ CARBONAS.

#### MAGNESIÆ CARBONAS LEVIS.



*Preparation.*—To prepare the heavy carbonate:—Mix *strong* solutions of sulphate of magnesium and carbonate of sodium in *boiling* water, evaporate to dryness, dissolve out the sulphate of sodium by hot water, filter, wash, and dry the precipitate at a gentle heat to avoid decomposition. By double reaction, sulphate of sodium and insoluble carbonate of magnesium are produced, but some of the magnesian carbonate loses its  $\text{CO}_2$ , and the precise equation is—



In the preparation of the light carbonate the process is, mix

cold dilute solutions of the same salts as above, boil, filter, wash, and dry the precipitate. The reaction is identical with that for the heavy carbonate. An oxy-carbonate is thus formed, as is the case with the carbonates of bismuth, lead, and zinc.

*Characters and Tests*—As in the case of the oxide of magnesium, the two varieties of the carbonate differ from each other only in one being denser and more closely aggregated than the other. The partially crystalline form of the light carbonate is due to the slowness of its precipitation. Like magnesia and lime, the carbonate, although almost insoluble in water, is more soluble in cold water than in hot. It requires about 2500 parts of cold, and 9000 parts of hot water for solution.

The other tests have been already explained under Magnesium.

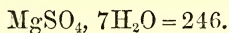
*In Pharmacy*.—The light and heavy carbonate yield on ignition, the light and heavy oxide respectively. From the heavy carbonate is prepared the *Liq. Magnes. Citratis*.

*In Medicine*.—In the solid form carbonate of magnesia acts chiefly as an antacid, and may be given in milk or some aromatic water. Mixed with citric acid or lemon juice it forms an agreeable effervescing aperient, a true citrate of magnesium. (*Liq. Magnes. Citr.*) What is often sold as “granular effervescing citrate of magnesia” does not contain citrate of magnesium, but is a mixture of citric and tartaric acids with bicarbonate of soda, with or without some sulphate of magnesia.

The “fluid magnesia” (*Liq. Magn. Carb.*) is an advantageous form for administration. It is similar in composition to the preparations known as Dinneford’s and Murray’s fluid magnesia, which have attained such reputation in acid dyspepsia and diarrhoea, in calculous and gouty affections, &c. “Dalby’s carminative” consists essentially of carbonate of magnesia diffused in peppermint water, flavoured with a number of aromatics, and including a small quantity of tincture of opium.



## MAGNESIÆ SULPHAS.



*Preparation.*—Sulphate of magnesium was originally procured by Dr. Grew, by evaporating the waters of saline springs at Epsom, and hence its popular name of Epsom salts. It is easily obtained on the large scale by acting on the native magnesium minerals with sulphuric acid.

*Characters and Tests.*—This salt can be obtained in large, colourless, transparent, rhombic prisms, or in short, thin needles, and in the former state, bears no small resemblance to oxalic acid, with which it has often been confounded, and with fatal results. But the magnesium salt is characterised by its disagreeable, bitter taste, recalling that of sea water, which indeed owes its nauseous taste to the presence of chloride and sulphate of magnesium.

Sulphate of magnesium is also quite similar in appearance to sulphate of zinc (white vitriol), from which it may be known by the precipitate produced with potash being insoluble in an excess of the reagent; or, by sulphide of ammonium producing a white precipitate ( $\text{ZnS}$ ) with the latter, and no visible change in the former. Sulphate of zinc is astringent to the taste.

The pure crystals slowly effloresce in dry air; if on the contrary, they deliquesce,  $\text{MgCl}_2$  (a very deliquescent salt), would be indicated; iron, a common impurity derived from the native mineral, is detected by the formation of a brown precipitate of hydrated ferric oxide ( $\text{Fe}_2\text{O}_3$ ) on the addition of chlorinated lime or soda. Or, yellow prussiate of potash would give Prussian blue with a trace of iron, if present.

The other tests have been already explained under Magnesium.

*In Pharmacy.*—Used in the preparation of the carbonates of magnesium. Solution of ammonio-sulphate of magnesium, Ap-

pendix II., is used in testing for phosphoric acid, e. g. *Ammonia Phosphas.*

Sulphate of magnesia should not be prescribed with Rochelle salt (*Sodæ et Pot. Tartras*), for although the solutions of these two salts are transparent when first mixed, yet after a short time, tartrate of magnesium will precipitate; nor with *Sodæ Bicarb.*, for sulphate of soda is formed, and will crystallise on the sides of the bottle (*Squire*).

*In Medicine.*—A mild and safe hydragogue cathartic, probably more in demand than any other member of this group. It is often used with a too unsparing hand, and without medical advice, in the commencement of fevers and inflammatory affections.

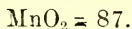
Natives and inhabitants of the tropics generally bear the operation of Epsom salts very badly, great depression being induced (*Waring*).

It operates with little pain or nausea, and is often given in combination with senna (*Mist. Sennæ Co.*), the griping quality of which it tends to correct. The dose for an adult often recommended is  $\bar{3}$ ss. to  $\bar{3}$ i., but it is far better to administer the salt in divided doses of  $\bar{3}$ i. to  $\bar{3}$ ij., freely diluted, repeated until the desired effect is obtained. A smaller relative dose is required if the salt be largely diluted. This is true of all saline medicines, and is amply illustrated by the activity of natural saline waters (*Stillé*).

It may be prescribed in a bitter infusion with a little spirit of lavender, and a combination of this salt with sulphuric acid and sulphate of iron forms an excellent tonic-aperient mixture.

Sulphate of magnesia dissolved in acid infusion of roses constitutes the “red bottle” of hospitals. For an injection, one oz. may be administered. (*Enema Magn. Sulph.*)

## MANGANESII OXIDUM NIGRUM.



There are two compounds of manganese in the Pharmacopœia, viz. the black oxide, and the permanganate of potassium. The black or per-oxide, called *pyrolusite*,\* is the commonest ore, and is found abundantly in Great Britain, and in various parts of Europe. The term manganese, which properly belongs to the metal, is often applied to this oxide.

*Characters and Tests.*—It occurs in nature in brilliant crystals, or in compact masses, but more usually as a dull, earthy, dark brown or black powder, which contains iron and other impurities. Treated with hydrochloric acid it evolves chlorine;  $\text{MnO}_2 + 4\text{HCl} = \text{MnCl}_2 + 2\text{H}_2\text{O} + \text{Cl}_2$ . Heated to redness it gives off oxygen, and leaves a residue of red oxide of manganese;  $3\text{MnO}_2 = \text{Mn}_3\text{O}_4 + \text{O}_2$ .

*In Pharmacy.*—Used in the preparation of Liquor Chlori, Liq. Sodæ Chloratæ, Potassæ Chloras, and in the formation of Permanganate of potash. It is also employed in the preparation of corrosive sublimate, in order to prevent the formation of calomel, and is utilised in the extraction of I from kelp, of Br from bittern, and of Cl from salt. In the arts it is employed for giving a black glaze to pottery, and in the manufacture of pink and purple glass.

*In Medicine.*—Several of the compounds of manganese, including the black oxide, lactate, citrate, &c., have from time to time been used in medicine as tonics and hæmatics, but they are seldom prescribed in these countries. In order to test the truth of the hypothesis, that substances closely allied chemically should have an analogous action on the system, Dr. Broadbent has tried the chlorides of manganese and nickel in cases of anæmia, with the object of comparing their effects with those of iron. He

\* Πῦρ, fire, and λύσις, a dissolution; from the readiness with which it is decomposed by heat.

observed tonic and hæmatic effects under their use, and found that manganese is much better borne by the stomach than nickel.

### OXYGEN.

Since black oxide of manganese is a common source of oxygen, it will be convenient to allude in this place to the uses of that gas.

Locally and generally, oxygen acts as a stimulant; when inhaled, it appears to increase the strength, to regulate and stimulate the appetite and digestion, and in fact, to act as a general tonic. The principal cases in which its inhalation has proved beneficial are, extreme anæmia (Trousseau), asphyxia from coal gas, suffocative dyspnœa, and asthma. One or two gallons may be inhaled in the day.

Solution of peroxide of hydrogen is sold under the name of "oxygenated water," and "ozonised water" has also been recommended. "Ozonic ether" is a solution of peroxide of hydrogen in ether. Peroxide of hydrogen is used for decolorising human hair. Notwithstanding its theoretically plausible claims, oxygen has never been well established in practice.

### MANNA.

*Origin.*—The term *manna* has been applied to no less than eight exudations of various composition found on different trees or shrubs, but the officinal kind is the product of two species of ash, *Fraxinus Ornus*, and *F. rotundifolia* (chiefly the latter), N. O. Oleaceæ. It is obtained by making deep longitudinal or transverse incisions on one side of the trunk. The same tree will continue to yield an annual crop of manna for thirty or forty years.

*Characters.*—Manna varies in character according to the mode of collection, the season, and other circumstances; but the purest is that named *flake manna*, which occurs in light, rough curved pieces, not very unlike fragments

of canella bark. Inferior manna is soft and light brown. Attempts have been made to counterfeit manna by potato sugar, and this fraud has been carried on with great success in France. The most abundant constituent, but not the purgative factor, of manna is a peculiar sweet principle, termed *mannite*, which forms about  $\frac{3}{4}$  of the weight of the manna. It is strictly a sugar, but does not undergo vinous fermentation in contact with yeast. The formula of mannite is  $C_6H_{14}O_6$  (i. e.  $2C_3H_7O_3$ ), and its real structure is that of an alcohol belonging to a hexatomic radical, thus,  $\left. \begin{array}{c} C_6H_8^{vi} \\ H_6 \end{array} \right\} O_6$ .

Dilute nitric acid converts mannite into two isomeric bodies, mucic and saccharic acids,  $(H_2C_6H_8O_8)$ . Manna also contains cane sugar and inverted sugar.

Mannite also occurs in certain fungi and seaweeds, in the exudations of apple and pear trees, also in some vegetables, as celery, onions, and asparagus. It is in fact widely distributed through the vegetable kingdom, as is only natural, seeing that it can be developed from cane sugar by the so called viscous fermentation.

The manna of the Jews has been stated to be either the *Lichen esculentus*, or to be a product of *Tamarix mannifera* (Sinai manna). Showers of lichen-manna, covering the ground to the depth of several inches, have been known to fall in Anatolia and Persia.

*In Medicine.*—A gentle aperient, at one time a good deal employed for children and delicate women, but apt to cause flatulence and griping, and now generally disused. Its bulk and the large dose requisite are serious objections to its use, and in the presence of so many officinal cathartics the absence of manna would not be much missed.

In the organism, mannite appears to behave like cane sugar; part is absorbed, and part converted into lactic acid. Manna, when kept for some time, is said to become more active.

## MARMOR ALBUM.

Used in Pharmacy only as a source of carbonic acid gas. It has already been referred to at p. 172.

## MASTICHE.

*Origin.*—The concrete juice of a shrub, *Pistacia Lentiscus*, N. O. Anacardiaceæ, a native of the countries bordering upon the Mediterranean. *Pistacia Terebinthus* yields the yellow Chian turpentine.

*Characters.*—Mastich is a true resin, and usually occurs in small oval or rounded tears, somewhat resembling gum arabic, but easily distinguished by its insolubility in water, e. g. when chewed. When rubbed or heated the odour becomes fragrant. It is at first friable under the teeth, but after being chewed for a little time becomes soft and opaque white. Mastich is mostly soluble in alcohol, and wholly in ether, chloroform, and oil of turpentine. It is chiefly composed of mastichic acid ( $C_{20}H_{30}O_2$ ), and masticin.

*In Pharmacy.*—Occasionally added to pill masses.

*In Medicine.*—It has no important effects, and is not used now internally. The Turkish women habitually chew it under the impression that it sweetens the breath and preserves the gums and teeth. Mastich is occasionally utilised as a stopping for carious teeth, but finds its chief applications in the preparation of varnishes and cements, and has no more right to a place in the Pharmacopœia than copal or many other resins used in the arts.



## MATICÆ FOLIA.

*Origin.*—Matico consists of the dried leaves of a Peruvian shrub, *Artanthe elongata*, N. O. Piperacæ. In 1863 the leaves of *Artanthe adunca* were imported as matico; they are nearly smooth on the under surface.

*Characters.*—In the imported packages of the drug the leaves, spikes, and stalks, are mixed together, and are all possessed of activity, although the leaves alone are recognised. The leaves are distinguished from all others by their long pointed form, and especially by the prominent veins intersecting each other, so as to form a square network on the upper surface. Matico contains little or no tannic acid, and its properties seem to be due to a volatile oil, and a resin.

*In Medicine.*—Matico is an aromatic tonic and stimulant, resembling in action black pepper and cubebs, and recommended in chronic diseases of the mucous membranes, especially of the urinary passages, but not much employed now. It has long been known as a medicine in Peru; and in this country, as well as in South America, is sometimes used as a local styptic. Its hæmostatic action is probably due, in great part, to the mechanical influence of the reticulated leaf.

## MEL.\*

## MEL DEPURATUM.

*Origin.*—Honey is a saccharine fluid, originally derived from the nectar or sweet juice of flowers, which is modified in the honey-bag, or œsophageal crop of the bee (*Apis mellifica*, Order, Hymenoptera), and transformed into honey. This is disgorged by the insects (the “neuters” or “workers”), and deposited in the cells of the honeycomb. It was formerly believed

\* Greek, Μέλι.

that the honey of the bee was identical with that formed in flowers; but that it is a true secretion is proved by the fact, that bees will form honey when they are fed on sugar and water only. The finest, or *virgin honey*, is that which spontaneously drains away from the comb of a hive that has never swarmed.

*Characters and Tests.*—Fresh honey is viscid and translucent; but on being kept it is apt to *candy*, i. e. become opaque and granular, owing to the separation of glucose in crystals.

The colour varies greatly, from nearly white through every shade of yellow to black, a Madagascar bee even produces green honey, and red honey occurs at Cayenne and Surinam.

Its odour and taste are familiar to every one; and it is well known that the flavour and other characters of honey are much affected by the nature of the plants to which the bees resort. The honey of some localities, e. g. Trebizond, and North America, is capable of producing serious and even fatal symptoms from contamination by various plants (Azalea, Rhododendron, Kalmia), belonging to the N. O. Ericaceæ, and also by mezereon.

Many cases of poisoning have been recorded, and in a few instances, the deadly influence of aconite has manifested itself through the medium of honey. The honey prepared from the nectar of the mint family is generally highly perfumed, and the celebrated Narbonne honey owes its superiority to this order of plants.

Honey is liable to many adulterations. For example, starch of some kind, detected by the iodine test; water, tragacanth, sand, grape sugar, clay.

The important constituents of honey are three different sugars, viz.; crystallisable cane sugar (sucrose); grape sugar (dextrose or glucose), also crystallisable; and inverted sugar, uncrystallisable, (a combination of glucose and levulose). When heated with caustic soda, honey assumes a garnet red colour.

In warm weather honey, if not very pure, sometimes ferments,

and in any case it is advisable to remove the flocculent matters suspended in it, which render it liable to decompose into mannite, alcohol, and acetic acid. Hence it is clarified (*Mel Depuratum*) by melting and straining, whilst hot, through flannel previously moistened with warm water.

At the same time honey exerts considerable antiseptic powers, and has been used in the preservation of animal matter. The bodies of the Spartan kings, who fell at a distance in battle, were preserved in honey, in order that they might be carried home. (Paris.)

*In Pharmacy.*—Chiefly used as the vehicle of more active medicines, or as the basis of confections; but as a menstruum, its place is better taken by glycerin. Sometimes employed in dispensing pills; and it has the advantage over syrup of not being so liable to crystallise and become granular. Mixed with  $\frac{1}{8}$  of water and  $\frac{1}{8}$  of acetic acid it constitutes *Oxymel*.

*In Medicine.*—Although largely consumed as a luxury or article of diet, it is now seldom used in medicine. A flour and honey poultice is a popular application to boils. Some persons cannot eat honey without suffering from nausea or purging, and others are affected with nettle-rash.

### MEL BORACIS.

Analogous in its uses to *Glycerinum Boracis* (see p. 164). It is employed in superficial inflammations of the tongue and mouth.

### MEZEREI CORTEX.

*Origin.*—Two plants belonging to the N. O. Thymelacææ yield Mezereon bark, viz., the common Mezereon, *Daphne Mezereum*, and the Spurge Laurel, *D. Laureola*, which however is less acrid. The bark of both root and stem is officinal.

*Characters.*—Distinguished from all other barks by its toughness and pliability, which are such, that strips of it can be firmly tied into knots.

The fresh bark of the true mezereon is brown externally, that of the spurge laurel is green. In the dry state the bark is nearly odourless, but when fresh it has a nauseous smell, and when chewed it proves irritating, and even corrosive.

The recent bark applied to the skin will cause vesication; and the berries have proved fatal to children.

The bark contains a glucoside termed *daphnin*, but its acidity appears to reside in an oleo-resinous substance.

*In Medicine.*—Occasionally employed externally as an irritant, and the Extr. Mezer. Æther. enters into the composition of the Linim. Sinapis Co. (8 grs. to ʒi.) In over doses, mezereon, taken internally, acts as an acrid poison, and excites purging and vomiting. Although it had at one time much reputation in the treatment of secondary syphilis, it is now seldom employed, but still lingers in the Dec. Sarsæ Comp.

### MICA PANIS.

*In Pharmacy.*—The only use of bread crumb in the Pharmacopœia is in the preparation of the charcoal poultice, but it is in extensive popular use as an emollient poultice simply boiled with milk or water.

### MISTURÆ.

Mixtures are generally left for extemporaneous prescription, but a few (11) have been introduced into the Pharmacopœia. Most of them are turbid, and they consist of oily and resinous substances, or of insoluble powders suspended in water by means of gum, sugar, and, in one case, milk.

A draught (Haustus) differs from a mixture only in quantity, and is usually taken in one dose. It is to be preferred when

a remedy is to be taken in a precise dose, when it is liable to spontaneous decomposition, or, whenever the action of the atmosphere occasions change (Paris.) The *Mistura Scammonii* is strictly a “*Haustus*.”

The average dose of a mixture is  $\bar{3}$ ss. to  $\bar{3}$ i., and the therapeutic uses of each are described under the respective drugs to which they belong.

### MISTURA AMMONIACI.

Is a simple aqueous emulsion of the gum-resin ammoniac, and was formerly called, from its white appearance, *milk of ammoniacum*. Most of the resin subsides on standing, and the liquid possesses a strong disagreeable odour and taste. *Enema Assafoetidæ* is an exactly analogous preparation, and is often termed, *milk of assafoetida*.

### MISTURA AMYGDALÆ.

This preparation is not at all unlike milk in appearance, and is commonly called *almond emulsion*, or *almond milk*. On standing, the fixed oil of almonds rises to the top, like cream, and the mixture soon spoils in warm weather.

Heat, alcohol, and acids, coagulate its albumen; facts that may be borne in mind in prescribing it. It is a bland, agreeable demulcent. An emulsion of *bitter* almonds might be similarly prepared, and is sometimes employed externally to relieve itching, and for other purposes. It contains a small quantity of prussic acid to which it owes its sedative properties.

## MISTURA CREASOTI.

An acetous solution of creasote flavoured with syrup and spirit of juniper. Contains one minim of creasote in  $\text{ʒi}$ . *Pure* creasote is entirely soluble in glacial acetic acid: A very convenient and useful formula.

## MISTURA CRETÆ.

Chalk mixture (14 grs. to  $\text{ʒi}$ .) is much employed either by itself, or in combination with opium and vegetable astringents. It is one of the most favourite remedies in simple febrile diarrhœa, and frequently proves effectual. It is, of course, incompatible with acids.

## MISTURA FERRI AROMATICA.

Commonly called Heberden's ink. It contains a very small quantity of iron per ounce, so that it is suitable for continued administration for a length of time. See p. 333.

## MISTURA FERRI COMPOSITA.

Usually known as Griffith's mixture. It is a useful stimulant tonic. On exposure to the air, the mixture gradually loses its green colour, and deposits a red sediment of  $\text{Fe}_2\text{O}_3$ . A similar change happens to chalybeate waters, most of which contain ferrous carbonate held in solution by excess of carbonic acid gas. When the carbonic anhydride escapes, the ferrous carbonate decomposes, red ferric oxide is formed, and hence the ochrey appearance of the soil in the vicinity of iron spas. But when properly made, this mixture will keep well for years. A specimen made in accordance with the *Dubl. Ph.* of 1850, preserved its colour and other characters unchanged for more than twenty



years although frequently exposed to the air. Since the quantity of iron per ounce is small, the use of the mixture may be long continued, but it is apt to disagree with some persons.

For an explanation of its preparation see Ferri Carb. Sacch.

### MISTURA GENTIANÆ.

Although gentian root contains no tannic acid, this preparation, like the compound infusion of gentian, will discolour iron salts, on account of the presence of bitter orange peel, which contains tannic acid. It is about double the strength of the Inf. Gent. Co. The proof spirit used in its preparation assists not only in dissolving the bitter principle, but also in the preservation of the mixture, which without this addition, would be very apt to spoil.

### MISTURA GUAIACI.

Illustrates the mode in which a resinous emulsion is prepared. Tragacanth is stated to answer better than gum arabic for suspending the resin.

### MISTURA SCAMMONII.

New milk is the best vehicle for the administration of scammony resin, and the mixture must, of course, be prepared only when it is wanted for immediate use. The whole quantity is to be taken for a dose.

### MISTURA SENNÆ COMPOSITA.

Is an improved form of the common "black draught," or *senna and salts*.

It contains  $\bar{3}i.$  of sulphate of magnesium in  $\bar{3}v.$  The liquorice

and cardamoms serve as correctives to the nauseous taste and griping qualities of the other ingredients.

### MISTURA SPIRITUS VINI GALLICI.

Commonly called "brandy-and-egg mixture," or "egg-flip." A useful and acceptable stimulant in low fevers, and other similar conditions.

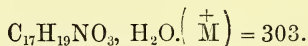
### MORI SUCCUS.

*Origin.*—The mulberry, *Morus nigra*, N. O. *Urticaceæ*, is a tree of medium size, which bears an oval dark purple fruit, composed of numerous minute drupelets, each fruit springing from a separate flower. The mulberry is technically termed a *sorosis*, i. e. it is a confluent fruit, and so differs from the apparently similar fruit of a blackberry, which is the product of a single flower.

*Characters.*—The fruit abounds in a deep violet red juice which contains tartaric acid.

*In Medicine.*—Used simply as a flavouring and feeble colouring agent, and may be added to gargles and mixtures.

### MORPHIA.



*Origin.*—Morphia, or morphine, is the most important constituent of opium, of which it forms from 6 to 10%. It exists in the state of meconate of morphia. Morphia was the first of the vegetable alkaloids isolated in a pure state.

*Characters and Tests.*—Morphia is a white, crystalline solid, distinguished from the other fixed alkaloids by its solubility in caustic potash or soda as well as in ammonia. It is not employed in the free state on account of its insolubility in cold water, viz.,

\* *Μορφευς*, the god of sleep.

one in 1000; it is almost insoluble in ether. Morphia is isomeric with piperin. The colour tests by which morphia or its salts are recognised are, (1) Nitric acid, which strikes an orange red colour, ultimately changing to yellow. A similar colour is produced with many other bodies, e. g. brucia (see Strychnia). (2) Neutral ferric chloride gives a greenish blue colour if the solution be not too dilute. These are the officinal tests, but they are not the most delicate known. (3) Iodic acid,  $\text{HIO}_3$ , a white solid, is decomposed by morphia, and iodine is liberated (Serullas), recognisable by the starch test. But since albuminous matters also reduce iodic acid, this test is only confirmatory of others. Solution of molybdate of sodium in strong sulphuric acid is a sensitive test (Fröhde), as is also Husemann's test, which consists in the addition of nitric acid or chlorine, i. e. an oxidising agent, to the warmed solution of morphia in sulphuric acid. Either of these tests will develop a blue or violet colour. Tannic acid, and all vegetable astringents containing tannin, precipitate morphia; pure gallic acid does not.

*In Pharmacy.*—Several salts of morphia have been recommended, but two only, the acetate and hydrochlorate, are officinal and will be presently described.

The salts of morphia are mostly crystallisable, odourless, with a very bitter taste; they are soluble in water and spirit, and insoluble in ether, chloroform, and amylic alcohol. Besides the two officinal salts, the sulphate, meconate, antimoniate, hydrocyanate, hydriodate, &c., have been proposed. The sulphate and meconate are suitable for hypodermic solutions.

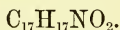
*In Medicine.*—Morphia and its compounds correspond on the whole in their effects with those of opium, to which the reader is referred; but the purity in which the alkaloid can be obtained, and the smaller dose of it which is necessary, are decided advantages in its favour. Morphia is stated to be more purely narcotic, less stimulant and exciting, less prone to cause constipation, and less apt to produce headache or nausea than opium.

For endermic and hypodermic use the preparations of the alkaloid are invariably selected.

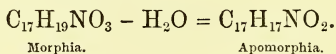
According to Schroff, who has made numerous experiments on the human body, the after effects of morphia are more enduring than those of opium, and the physiological action of opium cannot be exactly imitated by morphia alone, nor by a mixture of morphia, codeia, and narcotin.

Since the proportion of any of the ordinary acids necessary to neutralise morphia is very small, owing to its high molecular weight compared with that of the acid, the dose of the alkaloid and of its salts is practically the same, allowing for the differences of solubility. One gr. of acetate or hydrochlorate of morphia = about six grs. of opium.

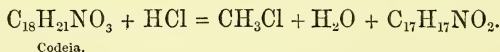
### *APOMORPHIA.* (Not Officinal.)



Apomorphia is a remarkable alkaloid which has recently been obtained by Matthiessen and Wright, from the decomposition of morphia or codeia. It is prepared by heating the hydrochlorate of either of these bases, in a hermetically sealed tube, with excess of hydrochloric acid:—



From codeia the equation is—

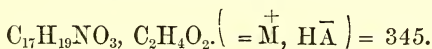


Apomorphia is a snow white base, but is unstable and rapidly turns green on exposure to the air. Although its hydrochlorate also quickly turns green in solution, it is more permanent than the free base, and is therefore preferred for use.

This new base differs totally in its physiological properties from morphia, and its most conspicuous effect is as an emetic of extraordinary power and rapidity:  $\frac{1}{30}$  to  $\frac{1}{10}$  gr. of the hydro-

chlorate subcutaneously, or  $\frac{1}{10}$  to  $\frac{1}{4}$  gr. by the mouth, will induce vomiting in a few minutes, painlessly, and without subsequent nausea or prostration. Apomorphia offers special advantages in dealing with refractory children, insane people, or with adults in some cases of poisoning, when coma, delirium, or spasm prevent the oral administration of emetics.

### MORPHIÆ ACETAS.



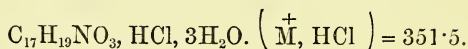
*Preparation.*—Dissolve freshly precipitated morphia in acetic acid, and dry with a gentle heat, because the acetate is easily decomposed, a portion of the acid escaping, and leaving uncombined morphia. The morphia is first precipitated by adding ammonia to the hydrochlorate. Eight parts of  $\overset{+}{\text{M}}, \text{HCl}$  yield about seven parts of  $\overset{+}{\text{M}}, \text{H}\bar{\text{A}}$ .

*Characters and Tests.*—May be obtained in needle shaped crystals, but usually occurs as a white powder. It is more soluble in water than the hydrochlorate, from which it is distinguished by evolving vapours of acetic acid on the addition of sulphuric acid. The other tests have been already explained under Morphia.

*In Pharmacy.*—Used in preparing the Liq. Morph. Acet., four grs. to  $\mathfrak{z}\text{i}$ . The Injectio Morph. Hypoderm. contains one gr. of the acetate in 12 m. of the solution.

*In Medicine.*—For an account of its action and uses, see Opium. Solution of the acetate of morphia is one of the most frequently used solutions for hypodermic injection, and for that purpose, in order to avoid irritation, the liquid should be made as nearly neutral as possible.

## MORPHIÆ HYDROCHLORAS.



*Preparation.*—The essential steps of the process (Robertson and Gregory's) are these:—

1. Exhaust thoroughly the sliced opium with water.

2. To the concentrated liquor add chloride of calcium. Double decomposition occurs with the meconates of morphia and codeia; meconate of calcium falls down, and impure muriates of morphia and codeia remain in solution.

3. Evaporate the product of (2) to solidification, wash out the muriates of morphia and codeia with hot water, decolorise with animal charcoal, and add ammonia, which precipitates pure morphia, leaving the codeia in solution.

4. Redissolve this pure morphia in dilute HCl and crystallise out the hydrochlorate. The yield of morphia from the different commercial kinds of opium varies considerably.

*Characters and Tests.*—Occurs as a white powder, or in silky, tufted crystals. Solubility in cold water, one in 16 or 20 parts; in cold spirit, one in 60. The salt is known to be a hydrochlorate by giving a white, curdy precipitate with nitrate of silver. It contains rather more than  $\frac{3}{4}$  of its weight of morphia. The other tests have been already explained under Morphia.

*In Pharmacy.*—Used in the preparation of Acetate of Morphia, and of the Injectio Morphiæ Hypodermica. The Liquor Morph. Hydrochl. contains four grs. of the salt in  $\text{ʒi.}$ , and the Suppositories  $\frac{1}{2}$  gr. each.

*In Medicine.*—Often prescribed internally as a sedative and anodyne, and for the other purposes to which opium is applicable. Frequently employed in hypodermic injection, for which purpose it is better suited than the acetate on account of its greater stability.



## MOSCHUS.\*

*Origin.*—The musk deer, *Moschus moschiferus*, Order, Mammalia, is a small, graceful animal, much resembling the fallow deer in shape and size, but without horns, dwelling among the mountainous regions of Central Asia.

On the under surface of the male animal is an oval, hairy sac, two or three inches long, situated between the umbilicus and the prepuce, and opening by a small orifice anteriorly. The musk of commerce is the brown, viscid secretion, varying in amount from ʒii. to ʒvi., which is formed within this glandular bag. The best musk comes from China (Tonquin musk). Siberian or Kabbardine musk is less esteemed. Up to Buffon's time musk was believed to be the pus of an abscess from which the animal freed itself by rubbing against rocks or trees.

*Characters.*—In appearance musk is not at all unlike brown snuff, or dried and powdered blood; its odour is familiar to every one. So penetrating and diffusive is it that one gr. of musk communicates its scent to more than 3,000 grs. of inodorous powder, and good musk will retain its odour for more than a century. The odorous principle has not been isolated. It is curious that the odour of musk is diminished or lost by contact with laurel water or hydrocyanic acid, ergot, sulphurated antimony, and volatile oil of mustard. The odour is said also to disappear completely when musk is thoroughly dried by means of fused chloride of calcium (Guibourt). On the other hand, the addition of a few drops of solution of potash or ammonia heightens the odour. A musky odour is common to both animal and vegetable kingdoms, and some women, especially negroes and mulattoes, emit it strongly during the menstrual period. (Stillé.) Musk is an inflammable body, and contains a number of volatile and other matters whose composition is not certainly known.

\* Arabic, *Mosch*.

Owing to its costliness, musk is frequently adulterated, and all kinds of substances are fraudulently mixed with the true drug—e. g. dried blood, tobacco, balsams, wax, hair, mineral matter, such as sand, and even bird's dung; while for the genuine musk sac is substituted, a piece of the skin of the musk deer, or the scrotum of the musk deer, or of a goat. Close inspection will reveal these sophistications, and, in doubtful cases, a microscopic examination of the concentrically arranged hairs on the sac may be required.

*In Medicine.*—Musk is a nervous stimulant and antispasmodic, and has long been in use in the treatment of low fever, hiccup, hysterical and spasmodic affections, &c. Its odorous principle is absorbed and appears to be eliminated by the respiration, sweat, and urine. Its high price, and the variableness of its quality, are sufficient to exclude it from general use, independently of the fact that we have abundance of other remedies, of similar powers and more convenient administration. From five to ten grs. in bolus or emulsion are a full dose.

### MUCILAGO ACACIÆ.

Common mucilage, or gum-water, is prepared with cold water, because the hot solution is more prone to change. By keeping, the mucilage becomes sour, owing to the formation of acetic acid, and is then unfit for medical or pharmaceutic purposes.

*In Pharmacy.*—Gum enters into the composition of all the Lozenges, and serves to bind their ingredients together. It is extensively employed in pharmacy, in the formation of pills, and for suspending or diffusing insoluble substances in water, such as resins, e. g. Mist. Guaiaci; inorganic salts, e. g. Mist. Cretæ, and oils, balsams, &c.

3iij. are required to emulsify ʒi. of oils, or of resinous tinctures.

## MUCILAGO AMYLI.

Starch-paste, so familiarly known, forms a convenient demulcent vehicle for injections, and is the basis of four out of the six officinal Enemata.

## MUCILAGO TRAGACANTHÆ.

This mucilage contains only six grs. of tragacanth in one ounce of water, tragacanth differing from all other gums in giving a thick consistence to a larger quantity of water (Paris). Tincture of iodine added to the mucilage develops after a few minutes a pale violet colour.

Occasionally used in making pills and lozenges, and for suspending heavy insoluble substances, e. g. Bismuthi Subnitras, in water.

## MYRISTICA.\*

*Origin.*—The nutmeg tree, *Myristica officinalis*, N. O. Myristicaceæ, is a moderate sized diœcious tree, which bears, after the eighth or ninth year, flowers and fruit. The fruit which is about the size and form of a peach, is smooth, yellow when ripe, and consists of three portions or layers.

1. The outer part, thick, succulent, and astringent at first, becomes dry when ripe, and separates into two or four valves.

2. Between these is disclosed a beautiful scarlet, fleshy, membranous network, which is collected and sold as *mace*. This, which is really an external covering to the seed, and is termed an *arillus* in botany, turns orange on drying, and appears in the market in flat irregularly cut pieces. It is not officinal.

\* *Μυριζω*, to anoint; because formerly used to impart its odour to ointments.

3. The seed, which consists of a hard kernel, i. e. *nutmeg*, enclosed in a thin, brown, shining shell. The seeds are first dried, then broken open, the kernels are removed from the useless seed coat, and steeped in a mixture of lime and water, or rubbed over with dry lime, to preserve them from the attacks of insects.

They require great care in curing. A single tree yields on an average six pounds of nutmegs.

*Characters.*—The form, odour, and flavour of the nutmeg (*nux moschata*) are generally known and sufficiently distinguish it from every other drug. What are known in trade as “long nutmegs” are an inferior sort, derived from *Myristica fatua*. A cross section displays an elegantly veined surface (*ruminated albumen*), somewhat resembling a section of betel nut, and caused by the involutions of the inner coat of the seed.

The kernel contains so much oil, that a greasy track is left when it is scored by the nail, and thus a rough test of the quality of the nutmeg is furnished.

By pressure, with the aid of heat, an orange fixed oil (*Ol. Myrist. Express.*) is abundantly obtained, 10 to 30% ; and by distillation with water, about 6% of a limpid volatile oil (*Ol. Myristicæ*) is procured.

The best nutmegs are heavy, small, rounded, and possess a strong fragrant odour. They are sometimes fraudulently punctured and boiled, in order to extract their volatile oil, or the holes made by insects are plugged up with powder scented with oil of nutmeg.

*In Medicine.*—Nutmeg is used only as an aromatic flavouring agent and carminative. In large doses it is capable of producing narcotic symptoms.

## MYRRHA.\*

*Origin.*—The myrrh tree, *Balsamodendron Myrrha* (B. Ehrenbergianum, *O. Berg.*), N. O. Amyridaceæ, is a small, stunted tree, and grows in the thickets of Arabia Felix and Abyssinia, interspersed among Acacias and Euphorbias. Myrrh is probably derived from two or three distinct, yet allied species (Hanbury). The gum-resinous juice exudes spontaneously and solidifies on the bark.

*Characters.*—The irregular, dark brown fragments or masses, sometimes as large as the fist, coupled with its peculiar odour, and bitter aromatic taste, distinguish myrrh from the other gum-resins, from which it is further separated by the large proportion of gum, about half its weight, which it contains. In addition it includes about 2% of volatile oil (myrrhol) and about 30 or 40% of resin (myrrhin). See Table of Gum-resins, p. 89.

Myrrh is sometimes adulterated with other gummy or resinous substances, such as bdellium, a soft, tenacious body.

*In Pharmacy.*—The Tinct. Myrrhæ is the only preparation in which the myrrh exists in the simple state.

*In Medicine.*—Myrrh is an aromatic tonic, and has long been credited with emmenagogue qualities, especially when combined with aloes, as in Rufus' pill (Pil. Aloes et Myrrhæ). But its claim to this position is certainly not well established, and its employment, which is mainly traditional, is more as an adjunct to other remedies than for any special virtues of its own.

The tincture is sometimes used as a local astringent application to spongy gums, herpetic sore mouth of children, and unhealthy ulcers.

\* Μύρον, a perfume.

## NECTANDRÆ CORTEX.

*Origin.*—The *Bebeeru*, *Nectandra Rodiæi*, N. O. Lauraceæ, is a lofty tree which inhabits Guiana and the neighbouring regions of S. America. It owes its specific name to Dr. Rodie, by whom it was first described.

*Characters.*—The bark occurs in flat pieces, and is not unlike yellow cinchona bark, but is easily distinguished by its greater weight, and by its dense hardness, so that it offers considerable resistance to the knife. The most important constituents of the bark are, tannic acid, of the kind that precipitates ferric salts green, and two alkaloids, viz., beberia ( $C_{19}H_{21}NO_2$ ), and nectandria ( $C_{20}H_{23}NO_4$ ). Possibly, other alkaloids exist in the bark. About  $1\frac{1}{2}\%$  of sulphate of beberia is obtained from the bark.

*In Pharmacy.*—Furnishes Beberia Sulphas, an impure salt, the preparation and characters of which are explained, p. 148.

*In Medicine.*—It is about forty years since *Nectandra* was introduced into practice, and hopes were at one time entertained that it might rival cinchona itself as a tonic and febrifuge. But though it undoubtedly possesses tonic, and probably anti-periodic powers, it has not been proved to have any special virtues, and its use is now almost abandoned. The average dose of Beberia Sulphas is five grs.

## NUX VOMICA.

*Origin.*—The *Strychnos*\* *Nux vomica*, N. O., Apocynaceæ (Loganiaceæ), is a tree of moderate size, which bears a yellow fruit about the size of an orange, in the pulp of which are imbedded the numerous flat seeds. Although the wood and root are very bitter, and are employed in the E. Indies for the

\* *Στρυχνος*, a species of nightshade; from the analogy of their deadly qualities.



cure of intermittent fever, the seeds alone are officinal. The bark is known as an adulterant of *Cusparia* (*angustura*) bark, and is called *false angustura bark* (see *Cusparia*).

*Characters*.—The seeds, which are about the size of a shilling, are perfectly distinguished by their shape, ash grey color, bitterness, and extreme hardness, so that it is difficult to make any impression upon them with the teeth. A vertical section of the seed exhibits distinctly the beautifully formed little embryo, placed just above a prominence visible externally. They are difficult to powder and must previously be thoroughly steamed and rapidly dried. Nitric acid turns the powder orange red.

*Nux vomica* contains three distinct alkaloids, amounting to about 0·4%, viz., strychnia,  $C_{21}H_{22}N_2O_2$ , brucia ( $C_{23}H_{26}N_2O_4, 4H_2O$ ), and igasuria, of which the first only is recognised. These are in combination with strychnic (igasuric) acid.

*In Pharmacy*.—It is the source of the important alkaloid Strychnia, under which heading an account of its preparation and properties will be given.

*In Medicine*.—The most important action of *nux vomica*, or of strychnia, which fully represents the drug, is that of a stimulant to the reflex function of the spinal cord and motor nerves, without markedly affecting the cerebral functions.

With large doses, the slightest external impression or exciting cause will give rise to tremblings and twitchings in the limbs, and, if the dose be excessive, to a state of tetanus. In fact, the symptoms of strychnia poisoning very closely resemble those of tetanus, and the differential diagnosis is sometimes not easy.

The history of the mode of onset, and the rapid development of the symptoms, will, however, generally be sufficient for the recognition of a case of strychnia poisoning.

Although the minimum fatal dose of strychnia will, of course,

depend on the individual, and on the condition of the stomach with respect to food and other circumstances, it should be remembered that  $\frac{1}{16}$  gr. of the alkaloid has killed a young child, and  $\frac{1}{2}$  gr. of sulphate of strychnia has proved fatal to an adult.

On the other hand, recovery has ensued upon the ingestion of three, four, or even five grs. of strychnia, and, in one curious case, life was preserved after twenty-two grs. of strychnia, and as much morphia, along with bitter-almond water, and chloroform, had been swallowed.

Drs. Crum Brown and T. R. Fraser, of Edinburgh, among their important investigations, have made the highly remarkable discovery that the convulsant action of strychnia is completely inverted by combination with the organic radicals, methyl ( $\text{CH}_3$ ) or ethyl ( $\text{C}_2\text{H}_5$ ), and that, for example, the iodide of methyl (or ethyl)-strychnium acquires properties analogous to those of curare, and actually induces motor paralysis.

Thus, the methyl and ethyl compounds of strychnia and brucia might literally be employed as *antidotes* to their parent alkaloids—a remarkable paradox.

Strychnia increases the afflux of blood to the spinal cord, and hence is contra-indicated in paralysis due to inflammatory or congestive conditions of this nervous centre. Ergot and belladonna exert an action of an opposite kind.

Strychnia operates in the same way by whatever channel it is introduced into the system, and its employment recently by hypodermic injection furnishes us with a precise means of apportioning its dose, and of observing its effects. It has been detected in the urine, blood (first by M'Adam, 1856), and tissues of poisoned animals, by tests which are explained under Strychnia. The blood of an animal poisoned by strychnia will, if administered to another, cause death.

Strychnia acts upon all classes of animals, but not equally.

Fowl are peculiarly tolerant of it, while frogs are extremely sensitive to minute doses. An E. Indian bird (*Buceros Rhinoceros*) is said to enjoy a special immunity towards strychnia.

In the treatment of strychnia poisoning, the chief indications are to evacuate the stomach as promptly as possible by mustard, to counteract the painful spasms by the inhalation of chloroform or ether, and, since there is no efficacious chemical antidote, to oppose the action of the poison by what are termed physiological antidotes. Tannic acid, animal charcoal, iodine, &c., have been recommended as chemical antidotes; but perhaps the best means of meeting the dangerous symptoms consists in the administration of nicotia, in  $\frac{1}{2}$  to 1 m. doses, in wine or brandy and water. An infusion of tobacco ( $\text{℥ss.}$  to a pint), in the absence of its active principle (nicotia), may be cautiously given in doses of  $\text{℥i.}-\text{℥ij.}$  by the mouth or by enema. Conia and curare have also been recommended, and, more lately, calabar bean and chloral. Tolerance of strychnia through continued use can be established both in animals and men, while, at the same time, it should be observed that sometimes a small increase of dose has appeared to act with cumulative effect, and has caused alarming symptoms and even death. In very small doses nux vomica and strychnia act as tonics and stimulants, and are frequently prescribed in atonic dyspepsia, gastrodynia, some kinds of diarrhœa and colic, in the constipation of paralysis, in incontinence of urine, &c.

As a nerve tonic, in epilepsy, especially when connected with anæmia, in chorea and neuralgia.

As a local stimulant to paralysed muscles the hypodermic injection of strychnia has been used with excellent results. Of a solution of sulphate of strychnia (gr. ij. to  $\text{℥i.}$ ), 5 m. =  $\frac{1}{48}$  gr. may be injected. Strychnia is also not unfrequently used endermically, i. e. sprinkled upon a blistered surface. The remarkable power of strychnia in relieving or curing certain forms of amaurosis has often been urged, and of late strongly insisted on, and it seems to merit further trial.

The therapeutic uses of strychnia may be summarily included under these heads :—

(*a.*) In motor paralysis of various kinds, especially palsies of local origin, paralysis of sphincters, and toxic paralysis, e. g. those due to alcohol, lead, or mercury.

(*b.*) In paralysis of the nerves of sensation and special sense.

(*c.*) In a number of other nervous diseases, e. g. chorea, epilepsy, asthma, &c.

(*d.*) In different affections of the digestive tract.

(*e.*) In intermittent fever, as a succedaneum to quinine.

(*f.*) In muscular atrophy.

The usual forms for prescription are the extract (gr.  $\frac{1}{4}$  to gr. i.); strychnia ( $\frac{1}{30}$  to  $\frac{1}{10}$  gr.) in pill; or the Liq. Strychniæ, 5 to 10 m. The Tincture may be given in somewhat larger doses, 10 to 20 m. Nitrate of strychnia is one of its most soluble salts, and is much used in Germany. In prescribing strychnia or its salts, the physician should always bear in mind the poisonous activity of small doses of this drug, and their cumulative action. The first evidences of its undue influence, viz. formation and muscular twitchings in the paralysed parts should be carefully watched.

*OLEA.*

The term “oil,” as in common use, represents several distinct and separate classes of bodies, which it is important not to confound. Thus we have (1) The mineral or rock oils (petroleums); these are all hydrocarbons. (2) The vegetable essential oils. (3) The vegetable and animal fixed oils. An oil is popularly understood to be either a liquid or solid substance, inflammable, lighter than water, and leaving a greasy, translucent stain on paper. The two classes, fixed and volatile, into which the officinal oils are usually divided, are essentially distinct, and have no relation to each other beyond the above general points of resemblance.

The points of contrast between these two groups will appear from the subjoined Table :—

FIXED OR EXPRESSED OILS.—TRUE  
FATS.

Are composed of palmitin, stearin, and olein, i. e. of palmitic, stearic, or oleic acid, in combination with glycerin.

Saponified by metallic bases.

All lighter than water.

Sparingly soluble in alcohol.

Cannot be volatilised without decomposition.

Leave a permanent greasy stain on paper.

VOLATILE, ESSENTIAL, OR DIS-  
TILLED OILS.

Are not compounds of glycerin.

Not truly saponifiable.

All lighter than water, except 4.

Readily soluble in alcohol.

Volatilise without decomposition.

Leave a temporary greasy stain on paper.

*FATS and OILS in the British Pharmacopœia.*

## FIXED.

## I. ANIMAL.

## A. CONCRETE.

1. Adeps Præparatus.
2. Cera Alba et Flava.
3. Cetaceum.
4. Sevum Præparatum.

## B. FLUID.

5. Oleum Morrhue.

## II. VEGETABLE.

## A. CONCRETE.

6. Oleum Myristicæ Expressum.
7. Oleum Theobromæ.

## B. FLUID.

8. Oleum Amygdalæ.
9. „ Crotonis.
10. „ Lini.
11. „ Olivæ.
12. „ Ricini.

## VOLATILE.

## A. CONCRETE.

1. Camphora.

## B. FLUID.

2. Oleum Anethi.
3. „ Anisi.
4. „ Anthemidis.
5. „ Cajuputi.
6. „ Carui.
7. „ Caryophylli.\*
8. „ *Cinnamomi*
9. „ Copaibæ.
10. „ Coriandri.
11. „ Cubebæ.
12. „ Juniperi.
13. „ Lavandulæ.
14. „ Limonis.
15. „ Menthæ piperitæ.
16. „ Menthæ viridis.
17. „ Myristicæ.
18. „ Pimentæ.\*
19. „ Rosmarini.
20. „ Rutæ.
21. „ Sabinæ.
22. „ Sinapis.\*
23. „ Terebinthinæ.

\* Heavier than water.



*OLEA EXPRESSA.*

Fats and fixed oils, unlike the officinal volatile oils, which are exclusively vegetable, are derived abundantly both from the animal and vegetable kingdom. In plants they occur chiefly in the fruit, and in the cotyledons of the seed, but occasionally in the rhizome, e. g. *Filix Mas*. Since the oils are usually stored up in separate cells, they are procured by expression, with the aid of heat if necessary. When pure, fixed oils, with the exception of cod-liver oil, have but little odour, and they vary considerably in degree of viscosity. When exposed to the air they become acid and develop an unpleasant odour (rancidity). This can be hindered by the addition of a little creasote, oil of cloves or pimento, or of a balsamic substance, e. g. *Adeps Benzoatus*. Those oils which tend to become solid by absorption of oxygen are termed "drying oils," e. g. *Oleum Lini*; while others, e. g. *Oleum Olivæ*, have no such tendency. The non-drying oils alone are solidified by nitrate of mercury or by peroxide of nitrogen.

They are insoluble in water, but they can be administered in aqueous vehicles by first rubbing them up with mucilage, so as to form an emulsion. Their sp. gr. varies from 0.91 to 0.94. When heated beyond a certain point, they give off irritating vapours, containing, among other substances, *acrolein*, derived from the dehydration of glycerin:

$$\underset{\text{glycerin}}{\text{C}_3\text{H}_5\text{O}_3} - 2\text{H}_2\text{O} = \underset{\text{acrolein}}{\text{C}_3\text{H}_4\text{O}}.$$

All the ordinary fixed oils and true fats, whether animal or vegetable, are composed of one or more proximate principles known as stearin, palmitin, and olein. The two former are solid, and the latter fluid, and on the relative proportion of these three bodies depends the consistence of any particular fat. The larger the proportion of olein, the softer is the fat, and the lower its melting point. Hard fats, e. g. suet, consist chiefly of stearin.

These proximate principles consist of their respective fatty acid in union with glycerin, stearin being a *stearate* of glycerin, and so on, the components being indicated in the name.

Now since glycerin is strictly an alcohol in its chemical relations, and as the product of the action of an oxacid on an alcohol is termed a "compound ether," all ordinary fats are really compound ethers of the triatomic alcohol glycerin, i. e. they are the glycerin salts (glycerides) of fatty acids (see Glycerin). Wax and spermaceti are compound ethers of monatomic alcohols. (See Table of the fatty acids, in Atfield's Chemistry, 4th edit., p. 466, taken from Miller's Elements of Chemistry).

A "soap" differs from a "fat" in containing a metallic radical (K, Na, Ca, Pb) in union with the oleic or other fatty acid, instead of the radical (glyceryl,  $C_3H_5'''$ ) of glycerin. The fatty acids are all monobasic.

*In Pharmacy.*—Fixed oils are used (*a*) for dissolving other drugs, e. g. phosphorus (Oleum Phosph.), and camphor (Linim. Camph.); (*b*) in the preparation of Liniments, Plasters, Ointments, Soaps, and Suppositories.

*In Medicine.*—Fats are employed (*a*) as emollients and demulcents, to relieve pain and irritation; (*b*) as mild purgatives, e. g. Castor oil; (*c*) in poisoning by caustic alkalies; (*d*) as nutrients, e. g. cod-liver oil; (*e*) as active cathartics, e. g. croton oil. Vegetable oils are less easily diffusible and probably also less oxidisable in the system than animal oils, and hence the superiority of cod-liver oil over any of the vegetable fats which have been proposed as substitutes for it.

### OLEA VOLATILIA.

Essential or volatile oils are widely diffused throughout the vegetable kingdom, and absolutely inodorous plants are very rare. At the same time, the oils used in medicine or in the

arts are derived from comparatively few Natural Orders, not more than ten or twelve.

As a general rule they exist pre-formed in the plant, and are therefore, *educts*; but in some cases, e. g. mustard and bitter almond, they are the *products* of the decomposition of certain principles already existing in the plant.

Volatile oils are generally contained in distinct cells, which are often so large as to be plainly visible to the naked eye, e. g. buchu and orange; and in the rind of some fruits, they exist in such abundance, that they may be procured by mere expression, e. g. *Oleum Limonis*.

But they are usually obtained by carefully distilling the plant with water; and in a few instances, e. g. mustard, the volatile oil is developed by a species of fermentation.

The proportion and quality of volatile oil in plants are influenced materially by a number of circumstances, such as season, mode of growth, soil, latitude, altitude, &c.

Their colour is commonly some shade of yellow, or yellowish-brown; oil of chamomile, however, is blue when recent, and oil of cajuput is distinguished by its fine green tint. They possess a hot and pungent taste, and their odour is strong, and often not very agreeable until they are freely diluted. The majority of them, especially the pure hydrocarbons, are lighter than water, but the oils of cinnamon, cloves, pimento, and mustard sink in water. The sp. gr. ranges between 0·847 and 1·095.

By age they deepen in colour, lose some of their aroma, become turbid, acid in reaction, and are finally converted, more or less, into resin by absorption of oxygen, particularly when exposed to the light. Some of the oxygen is, at the same time, transformed into ozone. They should therefore be preserved in dark bottles, filled, and carefully closed. The aldehydic oils oxidise into their corresponding acids, which often deposit in a crystalline state, e. g. benzoic acid from oil of bitter almonds, and cinnamic acid from oil of cinnamon.

Water exerts but a slight solvent action on them, yet it is impregnated with their odour and taste when distilled off them, as is seen in the "Waters" of the Pharmacopœia, e. g. Aqua Rosæ.

Trituration with magnesia, carbonate of magnesia, or sugar, greatly increases their solubility in water; like the fixed oils they are readily soluble in ether.

Alcohol dissolves them the more readily the stronger it is, and as a general rule, their solubility in spirit appears to increase with their proportion of oxygen. They mix readily with each other in all proportions, and they are also soluble in the fixed oils, e. g. Linim. Camphoræ.

Many of these oils, when frozen, separate into a solid and a fluid constituent, which may be isolated by compressing the congealed oil between folds of bibulous paper. The solid camphor-like matter is termed stearoptene, (*στέαρ* ; *πτηνός*), the fluid hydrocarbon, elæoptene, (*ἐλαιον* ; *πτηνός*). The more volatile elæoptene may be separated by distillation.

Considered in reference to their ultimate composition, the volatile oils are divisible into three sets.

1. The non-oxygenated, or hydrocarbon oils,—the camphenes—composed only of C and H. To this division belong the members of the turpentine series, which are also remarkable for their isomerism. Thus, the essential oils of turpentine, juniper, savine, lavender, peppermint, cloves, and several others, are isomeric bodies, i. e. they possess the same ultimate composition, viz.,  $C_{10}H_{16}$ . Some of them, e. g. oil of cubebs, answer to the formula  $C_{15}H_{24}$ , which is the same ratio.

2. The oxygenated, or those including C, H, and O, are represented by most of the aromatic oils, e. g. oil of cinnamon.

3. The sulphuretted oils, including C, H, and S, with or without N.

These are marked by their powerful and often fetid odour, e. g. oils of mustard, horseradish, and assafœtida, and they are

chiefly found in the Natural Orders, Cruciferæ, Umbelliferæ, and Liliaceæ.

To speak more precisely, nearly all vegetable odours can be distributed under three categories, viz., (*a*) Hydrocarbons; (*b*) Aldehyds; and (*c*) Ethers. The terebenes, or camphenes, as we have seen, belong to the first. Among the aldehyds are ranged the essential oils of rue, bitter almond, anise, fennel, canella, &c.; and essential oil of mustard falls into the class of compound ethers. Free acids occur in some, e. g. in oil of cloves, and alcohols in others, e. g. the menthol of oil of peppermint.

Various sophistications are practised on the volatile oils, the most common being admixture with fixed oils, resins, alcohol, and cheaper volatile oils.

The production of a *permanent* greasy stain on paper will disclose the presence of fixed oils, and both the fixed oils and resins are left behind when the adulterated oil is distilled with water. Several tests are described for the detection of alcohol, but the simplest method is to agitate the oil with water, when it will become turbid if alcohol be present.

A very small quantity of alcohol can be detected by Borsarelli's test. Add a fragment of clean chloride of calcium (acetate of potassium, Bernouilli), and warm gently for a few minutes. If alcohol be absent, the  $\text{CaCl}_2$  remains unaltered, but if it be present, the  $\text{CaCl}_2$  melts, or at least becomes pasty, and from the decrease in the volume of the oil, the amount of alcohol present can be known.

The detection of the admixture of one volatile oil with another is much more difficult, and no thoroughly satisfactory method has yet been proposed.

*In Pharmacy.*—Volatile oils are employed (*a*) in the pure state; (*b*) in the form of saturated aqueous solution, the officinal "Waters,"; (*c*) in solution in rectified spirit, one in five, *Essentia Anisi*, and *E. Menthæ Piper.*; and, (*d*) in solution in rectified spirit, one in fifty, e. g. many of the officinal "Spirits."

*In Medicine.*—With the exception of oil of turpentine, and one or two others, few of the volatile oils have any toxicological significance, and many of them are employed solely on account of their odour and flavour, or as correctives of bitter and nauseous medicines.

Locally, they are all more or less irritant, especially oil of turpentine and oil of mustard, while their remote action is exerted upon the nervous system, on the circulation, and finally upon the renal function.

Therapeutically, they are employed (*a*) as rubefacients and derivants, e. g. oil of turpentine ; (*b*) as stomachics and carminatives, e. g. oil of cloves, caraway, &c. ; (*c*) as antispasmodics, e. g. oil of cajuput ; (*d*) as diuretics, e. g. oil of juniper.

The average dose of an essential oil, internally, is from one to three minims, given on sugar, or in wine, or dissolved in spirit.

### OLEUM AMYGDALÆ.

*Origin.*—This oil, which is fixed, is not to be confounded with the essential oil of bitter almond (see p. 107), which is not officinal in the B. P., but is recognised in the United States Pharmacopœia. When either bitter or sweet almonds are submitted to pressure in canvas sacks between plates of iron slightly warmed, a turbid fixed oil exudes, which when clarified by rest and filtration, constitutes sweet oil of almonds. Sweet almonds yield 54% of fixed oil ; bitter almonds, 28%.

*Characters.*—A very bland and demulcent oil, not easily frozen, and nearly colourless and odourless. Sp. gr. about 0.92. It contains 76% of olein, and is a non-drying oil. Sometimes adulterated with poppy or colza oil, and with oil of apricots.

*In Pharmacy.*—Used in the preparation of certain ointments, and of *cold cream*, in preference to olive oil, as it makes a whiter ointment. It is also a good solvent for phosphorus, e. g. Oleum Phosphoratum.



*In Medicine.*—Rarely employed internally. Externally, it is an excellent emollient application to an irritable skin, and free inunction of the scalp with this oil facilitates epilation in favus and ringworm.

### OLEUM ANETHI.

Oil of Dill is a pale yellow, pungent, acrid fluid; sp. gr. about 0.980; it is seldom used in practice. It contains a hydrocarbon, anethene,  $C_{10}H_{16}$ , and an oxidised oil,  $C_{10}H_{14}O$ .

See Anethi Fructus.

### OLEUM ANISI.

*Origin.*—Oil of Anise is derived from two totally different plants. In Europe it is distilled from the fruit of *Pimpinella*\* *Anisum*,† N.O. Umbelliferae, popularly called *aniseed*; and in China, it is obtained from the fruit of *Illicium*‡ *anisatum*, N.O. Magnoliaceae, which is termed Star-Anise, from the stellate form in which the five to ten brown follicles are grouped round a central axis. Two or 3% of volatile oil is obtained from either source. Star-anise is more fragrant than common anise, and has to a considerable extent superseded it.

*Characters.*—The odour of the oil and its higher solidifying point, viz. 50° F., distinguish oil of European anise from other volatile oils. The Chinese oil solidifies at 35° F.

Anise oil is a mixture of a liquid hydrocarbon isomeric with oil of turpentine ( $C_{10}H_{16}$ ), and of a large proportion of a solid body or stearoptene (anethol),  $C_{10}H_{12}O$ . It is this latter

\* *Quasi*, Bipinella; because its leaves are doubly pinnate.

† *Ἀνίημι*, to emit, or send away; from its carminative qualities.

‡ *Illicio*, to allure; from its fragrance.

body which separates on cooling the oil below  $50^{\circ}$  or  $35^{\circ}$ , as the case may be. Oil of anise, in consequence of its high price, is sometimes adulterated with spermaceti, wax, camphor, or alcohol.

*In Pharmacy.*—The oil is soluble in all proportions in strong alcohol, and a spirituous solution of one part in five forms the Essence.

It is an ingredient of the English (Tinct. Camph. Co.) and Scotch (Tr. Opii Ammon.) paretoric elixirs.

*In Medicine.*—An agreeable aromatic carminative, long used in flatulent colic and as a corrective of griping or nauseous medicines. It has been supposed to have the property of increasing the secretion of milk.

Some liqueures are flavoured with it, and it is not so pungent as most of the other essential oils. Five to ten minims of the oil would be a full dose.

### OLEUM ANTHEMIDIS.

*Origin.*—English oil of chamomile, from *Anthemis nobilis*, is superior to the Continental oil, which is derived from *Matri-caria Chamomilla*, and hence it is directed that the oil be distilled in England.

*Characters.*—A blue or green oil, becoming yellow when aged, and possessing the characteristic odour and taste of the flowers, which contain about 0.8% of oil; sp. gr. 0.908. It is composed of a liquid hydrocarbon ( $C_{10}H_{16}$ ), and an oxidised portion ( $C_{10}H_{16}O_2$ ), which, when treated with liquor potassæ, yields potassic angelate. According to M. Demarçay, oil of chamomile is a mixture of several ethers, among which the angelates and valerianates of butyl and amyl predominate. The German oil contains a stearoptene ( $C_{10}H_{16}O$ ) isomeric with ordinary camphor.

*In Pharmacy.*—Added to the extract of chamomile, at the

end of the process, in order to supply the place of the oil driven off by the heat used in its preparation.

*In Medicine.*—See Anthemidis Flores. The recent experiments of Binz and Grisar show that oil of chamomile has a powerful effect in lowering reflex irritability (in frogs), and it may possibly prove even antidotal to strychnia.

### OLEUM CAJUPUTI.\*

*Origin.*—The cajuput tree, *Melaleuca minor*, N.O. Myrtaceæ, is of small size, a native of the Moluccas and the neighbouring islands, and yields by distillation from the leaves a scanty proportion of volatile oil.

*Characters.*—Distinguished from all other volatile oils by its fine green colour and penetrating odour, resembling that of camphor, rosemary, and cardamoms combined; sp. gr. from 0.914 to 0.920, and its boiling point is 347° F. Its composition is  $C_{10}H_{16}, H_2O$ . From its high price it is occasionally adulterated with oil of turpentine or other oils, and copper has been found in some specimens. If ordinary cajuput oil be re-distilled, the product is perfectly colourless.

*In Medicine.*—Cajuput is a powerful diffusible stimulant, and is much esteemed in the East. Internally, it has been especially recommended in spasmodic affections of the stomach and bowels, in chronic rheumatism, and chronic bronchitis.

Locally, it has been applied to relieve gouty and rheumatic pains, and in some skin diseases, especially acne rosacea. It enters into the Linim. Crotonis, the stimulant effects of which it heightens.

\* Malay, *Cayu-puto*, white tree.

## OLEUM CARUI.

Caraway yields about 4% of oil which possesses strongly the well known odour and taste of the fruit, and consists of two liquid bodies, viz., *carvene* ( $C_{10}H_{16}$ ), and *carvol* ( $C_{10}H_{14}O$ ) which is isomeric with thymol and cuminic alcohol. The oil is often used to impart flavour to medicines and to correct their nauseating and griping qualities. See Carui Fructus.

## OLEUM CARYOPHYLLI.

*Origin.*—Good cloves yield a considerable amount, 18%, of volatile oil, by repeated distillations, or by the application of super-heated steam.

*Characters.*—It darkens considerably by keeping, and is one of the least volatile of the essential oils. Its sp. gr. is about 1.060; and hence it sinks in water. Nitric acid reddens it, and forms oxalic acid. The composition of the oil agrees with that of pimento, viz., eugenic acid and a hydrocarbon,  $C_{15}H_{24}$ . See Caryophyllum.

## OLEUM CINNAMOMI.

*Origin.*—Of the two kinds of oil of cinnamon in commerce, viz., that derived from the officinal or Ceylon cinnamon, and that from the Chinese cinnamon (or Cassia), the Cingalese oil commands a much higher price. See Cinnamomi Cortex. Recent cinnamon bark contains about 0.6% of volatile oil.

*Characters.*—The oil changes from yellow to red by keeping, owing to absorption of oxygen and formation of a resinous matter, mixed with cinnamic acid ( $HC_9H_7O_2$ ). Specimens of the oil, when long kept, sometimes deposit crystals of cinnamic

acid, analogous to the crystals of benzoic acid often seen in essential oil of almonds. The chief component of oil of cinnamon (or Cassia) is hydride of cinnamyl ( $C_9H_7O, H$ ), which is the aldehyd of cinnamic alcohol, and which, when heated with nitric acid, yields essential oil of almonds ( $C_7H_5O, H$ ) and benzoic acid. The sp. gr. of the oil varies from 1·025 to 1·05; and therefore, like oil of cloves, it sinks in water.

*In Medicine.*—A cordial and agreeable carminative. See Cinnamomi Cortex.

### OLEUM COPAIBÆ.

When the oleo-resin copaiba is distilled with water, from 30 to 40% of a light yellow oil comes over, leaving a brown resin behind. Its sp. gr. is 0·878, and its composition  $C_{10}H_{16}$ . See Copaiba.

### OLEUM CORIANDRI.

An agreeable aromatic oil, obtained in very small quantity from the bruised fruit by distillation with water. Its sp. gr. is about 0·860, and its formula  $C_{10}H_{16}, H_2O$ . See Coriandri Fructus.

### OLEUM CROTONIS.

*Origin.*—The Croton\* Tiglium, N.O. Euphorbiacæ, is a small monœcious tree, belonging to the same genus as that which yields cascarilla bark. It is a native of India, Ceylon, and the adjacent countries.

The seeds, which are the most active part of the plant, are rather larger than a grain of coffee, oblong, and rounded at the extremities, light brown, and often slightly mottled on the surface; but not smooth and speckled like castor oil seeds.

\* Κρότων, a dog-tick; from the shape of the seeds.

By pressure, a large amount of fixed oil (20 to 30% of the kernel) is obtained from the seeds. Most of it is prepared in England.

*Characters.*—The colour of croton oil varies from a light yellow to a dark brown, and it becomes more viscid by keeping. The slightest trace of it, taken into the mouth, causes a burning acrid sensation, which may last for hours. The oil is soluble in ether, oil of turpentine, olive oil, and (if prepared in England) in rectified spirit, e. g. Linim. Crotonis. The oil imported from India is not so readily soluble in alcohol; but the action of alcohol is so much modified by temperature, the age of the oil, &c., that it cannot be relied upon as a means of distinguishing the two varieties of croton oil. The oil appears to be partly composed of crotonate of glyceryl ( $C_3H_5, 3C_4H_5O_2$ ); according to some, no crotonic acid is obtainable from the oil, but a mixture of several other acids, among which is tiglic acid,  $H_2C_5H_7O_2$ .

*In Medicine.*—In large doses, croton oil is a most violent irritant, and is capable of causing death in small quantities. In medicinal doses, it is an active and valuable hydragogue cathartic, presenting the advantages of rapidity of action, and certainty of effect in a small dose. It usually operates within an hour or two, and is of great utility in the treatment of obstinate constipation and comatose affections. Some cases of dropsy are benefited by it, and it has been lauded in neuralgia and epilepsy.

*Externally,* the oil produces inflammation of the skin, attended with a small vesicular or vesico-pustular eruption, differing in appearance from the angry red papulo-pustular eruption caused by tartar emetic ointment. The Liniment is a convenient mode of applying counter-irritation in neuralgia, rheumatism, and in laryngeal and pulmonary diseases. The vesicating effects of the oil sometimes spread far beyond the immediate seat of application, and even the whole surface of the trunk and limbs may be thickly studded with innumerable pearly vesicles, the result of



a *single inunction* of croton liniment into the back by the hands of an attendant.

One minim is a full dose of croton oil, and it is best given in pill; but a much more advisable plan is to employ the oil as an adjuvant to other purgatives. An excellent and certain cathartic is obtained by incorporating one minim of croton oil with twenty grains of Pil. Coloc. Co., and dividing into six pills;  $\frac{1}{6}$  gr. of podophyllin may be added to each pill with good effect.

Mixture, or emulsion, is not an admissible form of administration on account of the irritant effects of the oil upon the fauces and throat.

### OLEUM CUBEBAE.

Cubebs contain a considerable amount of oleo-resin, and by distillation with water, about 7% of a yellow volatile oil is obtained.

Its sp. gr. is 0.929, and formula,  $C_{15}H_{24}$ .

Its medicinal qualities agree with those of cubebs, and it may be given suspended in water by means of gum or sugar, or enclosed in capsules of gelatin. See Cubeba.

### OLEUM JUNIPERI.

*Origin.*—*Juniperus*\* *communis*, N. O. Coniferae, a native of Europe, is an erect evergreen shrub, with numerous close set branches, and narrow sharply pointed leaves. The fruit, often improperly called a berry, properly, a “galbulus,” is a small rounded cone, marked superiorly with a tri-radiate groove, the scales of which are fleshy, and coalesce ultimately. As imported, the

\* As if *Juveniperus*; because it brings forth young fruit while the old is maturing.

“berries” are not unlike dried black currants. The fruits contain a yellow pulp, with three angular seeds in each, and owe their odour, taste, and medical properties to 0·4% of a volatile oil, which is most abundant in the *unripe* fruit. In the completely ripe fruit the volatile oil is converted into resin. Similarly, cloves and some other drugs lose their aroma if allowed to ripen.

*Characters.*—The English oil is much inferior in flavour to the imported oil, which is probably procured from the flowering tops as well as the fruit.

The composition of the oil is  $C_{10}H_{16}$ , isomeric with oil of turpentine, and its sp. gr. is 0·855.

*In Medicine.*—Juniper is a stimulant diuretic, and imparts to the urine a smell of violets. It is mainly used in the treatment of dropsical affections, and the dose of the Spiritus Juniperi is from ʒss. to ʒi. Mistura Creasoti is flavoured with juniper, and the fruit is largely consumed in the preparation of gin.

## OLEUM LAVANDULÆ.

*Origin.*—The common Lavender, *Lavandula\** vera, N. O. Labiatae, is a native of Europe, and is abundantly found on dry and barren soil in Spain, Italy, and the south of France. It is cultivated in England for commercial purposes. The flowers are small and blue, and furnish, on distillation, a moderate quantity of volatile oil, upon which the virtues of the plant depend. One pound of the flowers yields from ʒi. to ʒv. of oil.

*Characters.*—The odour of lavender oil is very agreeable, and the fragrance of the English oil is superior to that of the imported oil, which is frequently obtained from *Lavandula Spica*. Its sp. gr. is about 0·880; it contains a hydrocarbon,  $C_{10}H_{16}$ , and by oxidation, it yields common camphor; some  $CO_2$  and water being extricated, as with oil of anise.‡

\* *Lavo*, to wash; because formerly used to perfume baths.

*In Medicine.*—Lavender is a carminative and aromatic stimulant; but is chiefly used as a perfume, and as a flavouring addition to other medicines.

### OLEUM LIMONIS.

*Origin.*—This oil, although a volatile one, can be obtained by simple expression as well as by distillation, because the oil is stored up in distinct little vesicles which are seated in the exterior of the rind. The oil procured by pressure possesses the peculiar flavour of the fruit in the highest degree.

*Characters.*—A very volatile fragrant liquid, sp. gr. 0·850. Its chief component is a hydrocarbon ( $C_{10}H_{16}$ ) isomeric with oil of turpentine, but it also contains small quantities of oxidised bodies,  $C_{10}H_{10}O_5$ , and  $C_{15}H_{10}O_5$ ; its hydrocarbon is susceptible of a number of modifications.

*In Pharmacy.*—Used only to impart odour or flavour to other medicines, e. g. Spir. Ammon. Arom.

### OLEUM LINI.

*Origin.*—For medicinal use the oil should be extracted without the aid of heat, i. e. be *cold-drawn*, and should not be kept too long, as it is liable to become rancid quickly on exposure. The seeds yield from 20 to 27% of oil, 10 to 12% remaining in the residual oil cake.

*Characters.*—Its sp. gr. is 0·932, and it does not freeze until within a few degrees of zero. When exposed to the air in thin layers it readily absorbs oxygen, and hardens into a dry resin; hence it is called a “drying oil.” It consists mainly of linolein, i. e. lin-oleate of glycerin, with a little palmitin and stearin. Pure linseed oil is not solidified by nitrate of mercury; rape seed oil is.

*In Pharmacy.*—Formerly it entered into the preparation of

Linim. Calcis (Carron oil), but it is now replaced by the more cleanly olive oil.

*In Medicine.*—Sometimes added to purgative enemata, but is seldom employed. In reference to its application to burns, &c., in the form of Carron oil, it is to be observed that its avidity for oxygen may cause it to be a source of irritation to a wound, and hence, olive oil or glycerin is preferable to a drying oil.

## OLEUM MENTHÆ PIPERITÆ.

### OLEUM MENTHÆ VIRIDIS.

*Origin.*—Peppermint, *Mentha\** *piperita*, and Spearmint, *M. viridis*, N. O., Labiatae, are indigenous to Great Britain, and though rare in the wild state, are abundantly cultivated on account of their volatile oil.

*Characters.*—Either species of mint yields on distillation a small proportion of oil (less than 1%), which is colourless or pale yellow at first, and becomes reddish by age. Sp. gr. about 0.920. Oil of peppermint consists of a peculiar hydrocarbon, menthene,  $C_{10}H_{18}$ , and of hydrated menthene,  $C_{10}H_{18}, H_2O$ , a crystalline stearoptene deposited on long standing. Oil of spearmint corresponds to the formula  $C_{10}H_{20}O$ .

*In Pharmacy.*—Peppermint possesses strongly the power of concealing the taste of nauseous medicines and is introduced for this purpose into Pil. Rhei Co.

Aqua Menth. Pip. is the best vehicle for Conf. Tereb. There are two alcoholic solutions of the volatile oil, viz. the Essence and the Spirit, the former of which is ten times as strong as the latter.

*In Medicine.*—The mints are aromatic stimulants, often used to allay nausea, and to relieve flatulent and spasmodic pains of the stomach or bowels.

\* *Minthe*, a daughter of Cocytus, whom Proserpine changed into the herb mint, because she was beloved by Pluto.

## OLEUM MORRHUÆ.

*Origin.*—The common cod, *Gadus Morrhua* (*Morrhua vulgaris*) is the only recognised source of the oil, yet it appears that several other species of *Gadus* contribute to furnish the cod-oil of commerce. An old name for the fish was *Asellus* (the colour of the belly resembling that of the ass) major, and hence the term *Oleum jecoris aselli*, still seen in prescriptions.

*Preparation.*—The finest and purest oil is obtained by gently heating the perfectly fresh livers. If too much heat be employed, or as is sometimes done, the livers be allowed to stand exposed to the sun and to putrefy, a brown or dark oil is obtained, which is very offensive to the smell and taste. 28 lbs. of the livers yield 12 lbs. oil.

*Characters and Test.*—Whatever may be said to the contrary, there can be no doubt that the oil best suited for medical purposes is that which has least colour and the least disagreeable taste and odour; in fact, the purest and sweetest oil.

The odour, often compared to that of shoe leather, is familiar to most persons, and by distillation with alkalies, a pungent volatile base, trimethylamine, is obtained, which recalls and indeed constitutes the peculiar odour of herring-pickle. Trimethylia,  $C_3H_9N$ , is identical with the volatile base, secalia, obtainable from ergot. The sp. gr. varies from 0.915 to 0.929.

Besides the ingredients common to most fixed oils, viz., olein, and a little palmitin, and stearin, cod-oil contains acetin, with minute amounts of P, I, and Br, and also certain biliary principles, upon the presence of which the colour test for the oil is founded. This consists in the addition of strong sulphuric acid to the oil on a white slab, when a violet colour is developed, passing rapidly into a dull red. But this test, which is essentially the same as Pettenkofer's test (see Fel. Bovin. Purific.), merely indicates the hepatic origin of the oil, and we have as yet no certain means of identifying *cod* liver oil, or of detecting

fraudulent additions or substitutions. Moreover, the shade of colour with sulphuric acid varies in different specimens of the oil.

*In Medicine.*—The main action of the oil is that of a nutritive tonic which is easily assimilated, but it is not exactly known why this oil is so superior to others, certainly not on the score of the traces of I and Br. It was long employed in Germany in rheumatic and strumous diseases, but was re-introduced into general notice in Great Britain by Dr. Hughes Bennett, in 1841, and is now consumed by the hogshead. In all cachectic diseases, in the different forms of scrofula, in rickets, lupus, &c., it is abundantly made use of, but its chief value lies in the treatment of phthisis, in which it has effected more, according to Dr. C. J. B. Williams, than all other remedies put together. In many cases of obstinate chronic cutaneous diseases it is of great service, and its powers of fattening patients and enriching the blood are undeniable.

The most usual dose is a teaspoonful at a time for children, and a tablespoonful for adults, which may be gradually increased if necessary, and may be continued for a length of time. Occasionally it purges, and often nauseates, especially if much other fatty food be taken at the same time.

Many people, children especially, will take the oil by itself, but it is commonly given in some vehicle. A multitude of plans have been recommended, but it will generally be tolerated when administered floating on milk, or on an aromatic bitter tonic, such as quassia or gentian with tincture of orange peel. Sometimes an emulsion with gum, sugar, or yolk of egg is ordered, and oil of bitter almonds or cherry-laurel water is stated to effectually conceal the nauseous taste of the oil. The addition of a little creasote (one or two m. to  $\bar{3}$  viij.) answers well with some patients. The froth of porter is often praised as a suitable vehicle, and cod liver pills also have been proposed. It should be taken soon after a meal.



*Locally*, the oil is sometimes applied to chronic joint-swellings, to lupus, and other skin affections.

Various substitutes have from time to time been proposed, but as yet with indifferent success. For example, glycerin, palm oil, various fish oils, dugong oil, &c.

No vegetable oil appears to have any claim to replace cod liver oil; but the oil of the livers of birds, or of mammals, or such delicacies as “*pâtès de Strasbourg ou de Nèrac*” (Gubler), would probably render the same services as cod liver oil.

Cod liver oil is sometimes medicated by dissolving in it quinia, phosphorus, or iodine.

### OLEUM MYRISTICÆ.

#### OLEUM MYRISTICÆ EXPRESSUM.

*Origin*.—Nutmeg is the only officinal drug from which is derived both a fixed and a volatile oil.

*Characters*.—The volatile oil, sp. gr. about 0·948, is a nearly colourless fragrant liquid. It is composed of two hydrocarbons,  $C_{10}H_{16}$ , and cymene,  $C_{10}H_{14}$ , and of myristicol,  $C_{10}H_{16}O$ . (Wright.)

The fixed oil is an orange yellow solid, of firmer consistence than butter, and popularly called *butter of nutmeg*, or improperly, oil of mace. This solid oil is imported into Europe in rectangular bars, enveloped in the leaves of an endogenous plant. As prepared in England, the oil is of a brighter and redder colour. (See *Myristica*.) It is partly composed of myristin, i. e. myristate of glyceryl,  $C_3H_5$ ,  $3C_{14}H_{27}O_2$ ; and it also contains olein, butyryn, and an acid resin.

*In Pharmacy*.—Used as aromatic additions to other medicines. The expressed oil of nutmeg occurs only in two plasters.



## OLEUM OLIVÆ.

*Origin.*—The olive tree, *Olea Europæa*, N. O. Oleaceæ, is a small tree which flourishes in all the countries bordering on the Mediterranean, and begins to bear fruit after the second year. The fruit (olive) is a smooth, oval drupe (stone-fruit), green at first, but afterwards violet coloured, with a fleshy pericarp containing a hard nut.

By bruising and pressing the fruits the fixed oil is abundantly obtained.

*Characters.*—The quality of olive oil (sweet oil) varies much according to the condition of the fruit, the details of preparation, and the time it has been kept. The purest oil, which comes from the south of France, is nearly colourless and odourless, and keeps well, but it is frequently adulterated with the cheaper oils, especially poppy and colza, which when in small quantity, are not easy to detect. The sp. gr. is about 0.915, and when cooled, it partially congeals at 36° or 38° F., a little solid palmitin and stearin separating out. When exposed to the air it becomes thick, but does not dry up like linseed oil. Nitrate of mercury, and yellow nitric acid, convert it into a solid compound, elaidin.

Olive oil is mainly composed of olein (72%), i. e. oleate of glycerin,  $C_3H_5, 3C_{18}H_{33}O_2$ ; and when mixed with any base, e. g. in the process of soap-making, double decomposition occurs, an oleate of the base is formed, and glycerin set free. Two of the liniments, viz. Lin. Ammon., and Lin. Calcis afford examples of a similar reaction. Cholesterin has also been found in olive oil. (Beneke).

*In Pharmacy.*—Used extensively to give proper consistence to plasters and ointments, as a basis for liniments and enemata, and as an emollient addition to poultices (Catapl. Lini.) and to Charta Epispastica. The Emplastrum Plumbi is a true lead soap. Olive

oil dissolves various alkaloids, and is used for that purpose in Ung. Veratriæ. Oleic acid dissolves alkaloids even more readily.

Hard and soft soaps are respectively oleate of sodium and oleate of potassium.

*In Medicine.*—Like other fats, olive oil is nutritious, and in full quantities mildly laxative, but it is almost exclusively employed for external use.

The unripe olives, properly prepared, are frequently eaten.

### OLEUM PHOSPHORATUM.

*Preparation.*—Dissolve phosphorus in (fixed) oil of almonds, heated to 180°. The oil is directed to be previously heated to 300°, in order to expel any water, and to coagulate any trace of albuminous matter present which might cause precipitation of some of the phosphorus.

*Characters.*—A light straw coloured liquid, luminous in the dark. It contains 0.74% of phosphorus. Dose 5 to 10 m.; i. e.  $\frac{1}{30}$  to  $\frac{1}{15}$  gr. of phosphorus.

*In Medicine.*—The best way of administering this oil is in gelatin capsules, but even then, it is liable to induce gastric irritation and nauseous eructations, probably owing to the formation of phosphuretted hydrogen. The oil may also be administered in emulsion with yolk of egg, and liquor potassæ.

### OLEUM PIMENTÆ.

The unripe berries of Pimento (Allspice) yield by distillation 1 to 4% of a reddish volatile oil, which has an agreeable pungent odour and taste. Its sp. gr. is 1.020, and its composition is much the same as that of oil of cloves. The oil is a stimulant aromatic, but is scarcely ever used.

## OLEUM RICINI.

*Origin.*—The Castor\* oil plant, or *Palma Christi*, *Ricinus† communis*, N. O. Euphorbiaceæ, is a large vigorous plant, which in the East Indies and Africa, its native countries, may attain the height of thirty or forty feet, but in these latitudes is an annual, and seldom rises above five or six feet. The leaves are palmate (*Palma Christi*), with seven to nine pointed and serrate lobes, and the flowers are monœcious, i. e. the sexes are in separate flowers, the lower portion of the inflorescence being occupied by the male (stamens) flowers, and the upper by the female (pistils). The seeds, from which the officinal fixed oil is extracted are contained in a three-celled spiny capsule, each cell containing one seed. The grey seeds are about as large as a small bean, oval, blunt at the extremities, one of which is capped with a small yellow tubercle (strophiole). They are very smooth and lustrous, and are beautifully marbled or variegated on the surface with brown spots and veins. The kernel of the seed is white, with a sweet, acrid taste, and contains nearly half its weight (46%) of oil. The seeds quickly become rancid, and are then unfit for the extraction of the oil.

It is a remarkable fact that the seeds, when swallowed, act much more violently as a cathartic than the oil itself, they often prove emetic, and are highly irritant.

The seed is energetically active after expression of the oil, and appears to contain some acrid purgative principle which has not been isolated.

The finest oil is obtained by simple expression, (cold-drawn) or with the aid of a very gentle heat.

\* The plant was called by the French *agnus castus*, from its supposed efficacy in soothing the passions.

† *Ricinus*, a tick; from the shape of the seeds.

*Characters.*—The purest oil is perfectly colourless and almost odourless, but the impure sorts are light brown and acrid. It does not congeal at  $0^{\circ}$  F., and is intermediate in characters between the drying and non-drying oils. It is solidified by nitrate of mercury and by orange nitric acid, and yields a solid crystallisable amide with ammonia. From other fixed oils, it differs in two particulars; it is heavier, sp. gr. 0.964, and it is soluble in its own volume of absolute alcohol. But concrete palm oil and *British* croton oil are also readily soluble in alcohol. The chief constituent of the oil is ricinoleate of glycerin (ricinolein) =  $C_3H_5, 3C_{18}H_{33}O_3$ .

When exposed to the air it is apt to become rancid, and unfit for use. The Italian oil is the finest.

Castor oil is adulterated with other fixed oils (olive oil, &c.), and a most dangerous fraud consists in the addition of a small quantity of croton oil to it, with the view of increasing its activity. This mixture is sometimes sold in capsules as “concentrated castor oil.”

*In Pharmacy.*—It imparts elasticity to collodion (Coll. Flex.), gives the requisite viscosity to Linim. Sinapis Co., and binds together the dry powdery ingredients of Plummer's pill (Pil. Hydr. Subchlor. Comp.)

*In Medicine.*—Good castor oil is in universal favour as a mild, safe, and speedy purgative. It is constantly employed in the treatment of ordinary constipation, to remove acrid ingesta or irritating secretions from the bowels, is well adapted for children, and for pregnant and puerperal women, and in all cases where gentle purgation is desirable without causing local irritation. The “eliminant treatment” of Asiatic cholera by castor oil, which is so strongly advocated by Dr. G. Johnson, appears to be a very questionable practice. Infants bear a relatively larger dose than adults; possibly because they digest more of the oil.

It produces thin, feculent stools, but is not a hydragogue. It

escapes with the fæces as a kind of emulsion, and is sometimes recognised under the form of cheesy flakes or solid fatty masses. It does not gripe, and as the sole objection to the oil is its nauseous taste, various methods have been proposed for obviating this. While many people can take it alone, it may be given to fastidious persons floating on some aromatic (cinnamon) water, infusion of cloves, or on a little wine, or in emulsion with yolk of egg, tragacanth, or solution of potash. Oil of bitter almonds is said to conceal the taste well.

Mixed in a cup of hot sweetened milk or coffee, it makes a not unpleasant draught. If intestinal irritation or colicky pains be present a little laudanum may be added.

As an enema, alone, or combined with oil of turpentine, it is frequently of service. Locally, it is recommended as an application to the breasts of nursing women to promote the secretion of milk, and, with the addition of a little Friar's balsam (Tinct. Benz. Co.) it forms a capital dressing for bedsores.

### OLEUM ROSMARINI.\*

*Origin.*—Rosemary, *R. officinalis*, *N. O. Labiatae*, is a small evergreen shrub with numerous linear leaves, folded back at the edges, and white underneath. It is a native of the south of Europe. The flowering summits are the officinal portion; the whole plant has a strong balsamic odour, and a warm camphoraceous taste.

The flowers are much sought after by bees, and yield about 1% of volatile oil.

*Characters.*—The odour of the oil is perhaps less agreeable than that of the plant, and on standing, it sometimes deposits a stearoptene analogous to camphor. Sp. gr. 0.897. It is often

\* *Ros*, dew, and *marinus*; because, growing on the sea shore, it was said to appear early in the morning, like the dew.



adulterated with oil of turpentine, detected by its feeble solubility in rectified spirit.

*In Pharmacy.*—Used only to impart its odour or flavour to certain preparations, e. g. Linim. Saponis.

### OLEUM RUTÆ.

*Origin.*—Common rue, *Ruta graveolens*, N. O. Rutaceæ, is a small perennial shrub, a native of the south of Europe, with bi-pinnate leaves and yellow flowers. The whole plant has a strong disagreeable odour, especially when bruised, and is sufficiently acrid to inflame or even to vesicate the skin if it be much handled.

*Characters.*—By distillation less than 1% of a yellow fetid oil is obtained, which becomes brown by age. Sp. gr. 0·837. Its chief constituents are a hydrocarbon,  $C_{10}H_{16}$ , and methylcaprinol,  $C_{10}H_{19}(CH_3)O$ . Oil of rue has been obtained artificially.

*In Medicine.*—Rue is undoubtedly an active stimulant and antispasmodic, and is believed by some to exercise a special action over the uterus. It is sometimes criminally administered to procure abortion, but is liable to cause dangerous or even fatal gastro-enteritis.

Rue is seldom used now either in amenorrhœa, or in hysterical affections, and its disagreeable qualities furnish a sufficient reason for its disuse in practice.

### OLEUM SABINÆ.

Oil of savine is a colourless or yellow limpid fluid, with a strong, heavy odour, and an extremely acrid taste. Sp. gr. 0·915. It is isomeric with oil of turpentine,  $C_{10}H_{16}$ , to which also it is closely analogous in operation. Like some other hydro-

carbon oils, it detonates when mixed with iodine. For an account of its origin and uses, see *Sabinæ Cacumina*.

### OLEUM SINAPIS.

*Origin*.—The mode of development of this remarkable oil from black mustard seed is explained under *Sinapis*.

*Characters*.—This is the fourth officinal oil which is heavier than water. If adulterated with alcohol its sp. gr. would be reduced below 1·015. Oil of cloves, castor oil, and bisulphide of carbon, have been fraudulently added. It darkens in colour by age, and its disagreeable odour diminishes. When pure, it boils at 298°. It mainly consists of a compound ether, sulphocyanate of allyl,  $C_3H_5CNS$ , often associated with some cyanide of allyl,  $C_3H_5CN$ , due to partial decomposition of the sulphocyanate. It can be artificially prepared by decomposing iodide of allyl,  $C_3H_5I$ , with sulphocyanate of potassium,  $KCNS$ .

*In Pharmacy*.—Used only in the preparation of *Linim. Sinapis Comp.*

*In Medicine*.—This compound is one of the most active of the volatile oils, and is too powerful an irritant for internal use, unless very freely diluted. Three to five m. of a solution of 24 m. of the oil in ʒi. of spirit may be given in emulsion.

### OLEUM TEREBINTHINÆ.

*Origin*.—The term *turpentine* is properly applied to certain yellowish odorous vegetable exudations of varying consistence, which flow from the stems of trees belonging usually to the N. O. Coniferæ (Pinacæ), and which correspond in their general properties.

The same term is also incorrectly given to the volatile oil obtained by distillation from the true turpentine.

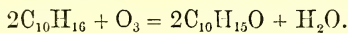
A large number of varieties of turpentine are found in commerce and are named after the country from which they are derived, e. g. American, French, and Chian turpentine. They are procured from different species of the genera *Pinus*, *Abies*, and *Larix*. Venice turpentine is derived from *Abies pectinata*, and not from the larch as is usually stated, and French (Bordeaux) turpentine comes from *Pinus maritima*.

They are either solid, e. g. Frankincense (Thus Americanum) and Burgundy Pitch, or liquid, e. g. Canada balsam (*Terebinthina Canadensis*), and they are all oleo-resins, i. e. mixtures of various resins with volatile oil. When subjected to distillation along with water, the colourless volatile oil (*Oleum Terebinthinæ*) comes over, and the solid resin is left behind in the still. Hence "Resina" is defined in the B. P. as "the residue of the distillation of the turpentines from various species of *Pinus* and *Abies*." The volatile oil is in all cases the active medicinal component.

The officinal oil of turpentine, commonly called *spirit* or *essence of turpentine*, briefly, *turpentine*, or in commerce, "*turps*," is rectified from the common American and French turpentine, the product of several species of *Pinus*. The crude turpentine yields from 17 to 24% of volatile oil.

All turpentines on exposure to the air become hard and dry, partly in consequence of the volatilisation, and partly of the oxidation of their essential oil into resin. They are readily inflammable, and burn with a white flame, producing much smoke. They are nearly insoluble in water, but are mostly soluble in alcohol or ether, and they readily unite with the fixed oils and soaps, e. g. Linim. *Terebinthinæ*.

*Characters*.—When pure and recent, the oil is perfectly limpid and colourless, but by exposure to the air it absorbs oxygen, becomes yellowish and thicker, and a resin is produced—



Formic and carbonic acids are also developed.

It not only absorbs oxygen, but in common with many other essential oils, converts part of the oxygen into ozone, and it is in virtue of this property that it can be used in the guaiacum process for the detection of blood.\*

Oil of turpentine boils at about  $314^{\circ}$  F., and is much lighter than water, sp. gr. 0.86; it is very slightly soluble in that medium, and less so in alcohol than most other volatile oils. Ether takes it up readily. It dissolves resins, fixed oils and fats, india-rubber, &c.

The pure oil has the composition  $C_{10}H_{16}$ , and many of the other essential oils have been shown to be isomeric with it.

Strong nitric acid acts so violently on oil of turpentine, that when gently heated it causes the latter to take fire.

Oil of turpentine, especially when recent, detonates when mixed with iodine. Chloroform can be obtained from it by means of chloride of lime.

The varieties of the oil behave differently towards polarised light. Thus, the English or American oil turns the plane of polarised light to the right (dextro-gyrate); while the German, Venetian, or French oil has the contrary effect (lævo-gyrate). Commercial oil of turpentine frequently consists of a mixture of isomers, each of which acts differently on polarised light.

*In Pharmacy.*—Oil of turpentine enters into five preparations. It is difficult to render it miscible with an aqueous vehicle unless it be first rubbed up with some dry absorbent powder, such as liquorice, in the Conf. Tereb. One drachm of mucilage,

\* A simple and satisfactory clinical test for blood, for example, in urine, is as follows:—Mix in a test tube a few drops of oil of turpentine with a drop or two of recent tincture of guaiacum (*not* the ammoniated tincture). Then add the suspected fluid; if the smallest trace of blood be present, a blue zone is formed at the junction of the liquids. A few drops of rectified spirit subsequently added will develop the blue colour more clearly.

by diligent trituration, will emulsify 3 ss. of oil of turpentine in ʒi. of water.

*In Medicine.*—Internally, the chief effects of oil of turpentine are, in small doses, stimulant, diuretic, and astringent; and in large doses, cathartic and anthelmintic. Externally, it acts as an irritant and rubefacient, and in susceptible constitutions may cause severe inflammation of the skin.

Small doses, 6 to 30 m., cause a feeling of epigastric warmth, acceleration of pulse, and diuresis.

With some individuals, when introduced into the system by any channel, even in small quantity, it proves highly irritating to the urinary passages, and causes strangury and bloody urine. Severe hematuria, lasting for two to three days, has been produced in a child who had accidentally swallowed a little oil of turpentine, and hematuria has also been observed in seamen on board vessels loaded with turpentine.

Continued inhalation of turpentine vapour, e. g. from a freshly painted room, will sometimes induce loss of sleep, headache, lumbar pains, hematuria, and even asphyxia. It imparts a violaceous odour to the urine.

In large doses it is liable to affect the head, and to cause vertigo, a sense of fulness, and even a kind of intoxication, and occasionally it gives rise to an erythematous eruption on the skin, in addition to griping and tenesmus.

The principal affections and conditions of the system in which oil of turpentine is found most beneficial are:—

1. As a stimulant, in low forms of continued fever, especially when associated with a dry sordid tongue, and a tympanitic state of the bowels. In puerperal and yellow fevers it has also been warmly recommended. In chronic rheumatism, and especially in sciatica and lumbago, it is frequently of much advantage, and in certain cases of epilepsy, and in chronic mucous discharges (diarrhœa, gleet, leucorrhœa) it proves highly serviceable.

In the treatment of chronic bronchitis with abundant secretion, prompt and striking benefit is often obtained from a turpentine mixture internally, conjoined with the application of turpentine stupes to the chest.

2. As an astringent and styptic it is one of the best means of meeting enteric hemorrhage and obstinate hemoptysis.

3. As an anthelmintic and cathartic it is destructive both to the flat and round worms, and a full dose of castor oil with oil of turpentine is a most efficacious if somewhat nauseous means of expelling these parasites. A turpentine enema will effectually remove ascarides, and few remedies are more certain in tympanitis or colicky affections than injections of oil of turpentine.

4. As an antidote to poisoning by phosphorus. (Andant.)

Externally, turpentine liniment makes a capital stimulating application for rheumatic and pectoral affections, and it allays the pain, and promotes the healing of recent burns. Turpentine stupes are efficacious in relieving abdominal pain and tenderness, and in dispersing flatulency.

The Linim. Tereb. Acet. represents the nostrum of the notorious quack, St. John Long. If undue irritation follow on the external use of turpentine, it may be promptly relieved by the application of olive oil on a piece of linen.

Inhalation of the vapour of turpentine is useful sometimes in cases of chronic bronchitis with copious secretion, and in gangrene of the lung.

The average dose as a stimulant, astringent, or diuretic is 10 to 15 m.; as an anthelmintic and cathartic,  $\text{ʒss.}$  to  $\text{ʒi.}$

The Conf. Tereb. is the best form for the internal administration of turpentine, and it is most suitably dispensed in some aromatic water, e. g. peppermint.



## OLEUM THEOBROMÆ.

*Origin.*—The *cacao*,\* Theobroma† Cacao, N. O. Byttneriaceæ, is a handsome tree of moderate stature which grows in Mexico, West Indies, and South America, and is largely cultivated on account of its nutritious oily seeds, from which the beverages and sweetmeat, *cocoa* and *chocolate* are prepared. The seeds contain, among other ingredients, an alkaloid *theobromine*, and about half their weight of fixed oil, the officinal *cacao butter*, which is extracted either by pressure between hot iron plates, or by decoction with water.

*Characters.*—Cacao butter and butter of nutmeg (Ol. Myrist. Express.) are the only two solid vegetable fats, and are both employed solely for pharmaceutic purposes. Cacao butter is imported in oblong cakes, somewhat like white Windsor soap, and possesses an aromatic odour which it loses by age. It consists largely of stearin, and is one of the best sources of stearic acid.

*In Pharmacy.*—Largely used in the preparation of Suppositories, for which purpose it is well adapted by its consistence and its freedom from rancidity.

## OPIUM.‡

*Origin.*—Two species of poppy are officinal, viz., the red (Papaver Rhœas), and the white poppy, Papaver somniferum, N. O. Papaveraceæ.

\* This plant and its product, *cacao* or *cocoa*, are not to be confounded with the *cocoa nut palm*; nor with *coca*, the leaves of Erythroxylon Coca, N. O. Erythroxyleæ, which is much used in South America as a stimulant.

† Θεός, a god, βρῶμα, food; from the delicious quality of its fruit.

‡ Ὀπός, juice. Meconium, Μήκων, the wild poppy; signified the black opium obtained by bruising the poppy heads.

The garden or opium poppy is a handsome erect plant, with large amplexicaul leaves, and conspicuous terminal flowers of a violet or silver grey colour, having a purple spot at the base of the petals.

The fruit (capsule) is smooth, oval or rounded, crowned with the persistent radiating stigmata, and contains a large number of minute white seeds, (*maw* seeds) which abound with a bland fixed oil (poppy oil), but are destitute of narcotic properties, and are even sometimes employed as food.

The plant is believed to be a native of Persia, but is common now throughout Europe, and is extensively cultivated in Asia Minor, India, and Egypt, for the preparation of opium.

It flowers in June or July, and the capsules ripen about two months afterwards.

*Collection.*—All parts of the mature poppy plant, but especially the capsules, abound in a white, opaque, narcotic juice. A few days after the fall of the petals, the unripe capsules are scarified with sharp knives, taking care not to penetrate into their cavity. The white juice exudes, gradually thickens, and next day is carefully scraped off by means of large blunt knives. The soft mass thus obtained is worked up into a proper consistence, and then wrapped in leaves and sent into the market.

*Adulterations and Impurities.*—Owing to the great demand and consequent high price for opium, all kinds of frauds are practised in this branch of commerce. Mud, sand, soot, cow-dung, various extracts, powdered leaves and stems of different plants, gums, grape skins, flour, and colouring matters, are some of the substances which have been used for this purpose.

The finest opium is derived from Asia Minor, and is termed in commerce Turkey or Levant opium (also Smyrna or Constantinople opium), but large quantities are also prepared in Egypt, India (Bengal, Patna, and Malwa opium), and Persia, and

inferior varieties in Europe (Britain, France, Germany, and Greece).

*Characters of Opium.*—Opium of good quality occurs in irregular rounded masses, covered with poppy leaves, and speckled with dock (*rumex*) fruits; composed of distinct agglutinated tears, at first soft, but becoming hard and dry by keeping. When cut, and rubbed smooth, it has a waxy lustre, a chestnut brown colour, and a peculiar and nauseous odour and bitter taste.

Inferior opium is soft, black, less uniform in structure, with a dull fracture, and comparatively weak odour.

*Purity Test.*—The opium merchant is practically guided in his estimation of the quality of samples by their sensible properties of colour, odour, texture, and consistence, but for an exact valuation of the medicinal worth of opium, we must resort to the tedious process of the quantitative determination of the morphia, as directed in the test given in the British Pharmacopœia, which is a modification of Mohr's process.

The proportion of morphia in the different sorts of opium is very various, but an average specimen of opium ought to yield at least from 6 to 8% of morphia, and as much as 10 or 12% is obtained from fine samples. Dry Smyrna opium sometimes contains over 21% of morphia.

*Constituents of Opium.*—The chemical constitution of opium has been and still is the subject of much inquiry, and it is worthy of notice that it was by their investigations into the nature of this drug that chemists were led to the discovery of the vegetable alkaloids—those active principles which have justly attracted so much attention, and now occupy a leading place in modern therapeutics.

The complex nature of opium is well known, and several definite and peculiar alkaloids can be extracted from it; but not a few of the supposed discoveries have turned out to be deceptive, and it is difficult to resist the impression that some

of the substances trumpeted as new discoveries are the results of decomposition in the varied processes by which opium is tortured to yield up its secrets.

The most important constituents in a chemical or medicinal point of view are as follows :—

1. *Meconic acid* ( $\text{H}_3\text{C}_7\text{HO}_7, 3\text{H}_2\text{O}$ ), a white crystalline tribasic acid, about 4%, which appears to be inert as a medicine. With  $\text{Fe}_2\text{Cl}_6$  it gives a deep red colour (meconate of iron), which differs from the red of ferric sulphocyanate in not being bleached by corrosive sublimate. This test is an important one medico-legally, for it affords direct evidence of the presence of opium, since meconic acid is obtainable from opium alone. It is so delicate that a drop of solution of ferric chloride will distinctly redden a few drops of the very weak solution of opium, paregoric elixir (Tr. Camph. Co.)

2. *Morphia* ( $\text{C}_{17}\text{H}_{19}\text{NO}_3$ ), the most important of all. It exists in the opium as meconate, varying from 2 to 12%. Pure morphia is not used in medicine on account of its insolubility in water. Its salts, the hydrochlorate and acetate, and the colour tests by which it is recognised, have been already described. See p. 456.

Morphia and narcotin were the first principles isolated from opium.

3. *Codeia* ( $\text{C}_{18}\text{H}_{21}\text{NO}_3, \text{H}_2\text{O}$ ), much more soluble in water and ether than morphia; it forms from  $\frac{1}{4}$  to 1% of opium. Although a good deal used on the continent, it seems on the whole to be decidedly inferior to morphia. Dose,  $\frac{1}{2}$  to 1 gr.

4. *Thebaia or paramorphia* ( $\text{C}_{19}\text{H}_{21}\text{NO}_3$ ), a powerful convulsant poison, causing tetanic symptoms similar to those produced by strychnia. It is the most dangerous of the opium alkaloids, and is not used medicinally;  $\frac{1}{36}$  gr. will kill a mouse in a few minutes (J. Harley). It is a white crystalline base, and forms about  $\frac{1}{6}$ % of opium.

5. *Narcotin* or *opian* (salt of Derosne), ( $C_{22}H_{23}NO_7$ ), a white crystalline solid, soluble in ether, less active than the preceding alkaloids. It has been recommended as a tonic and antiperiodic, and has been used with success as a substitute for quinine in intermittent and remittent fevers; constitutes about 6% of opium. Dose, as a tonic, 1 to 3 grains; as an antiperiodic, 5 to 20 grains. Its hypnotic influence is not well marked.

6. *Narcein* ( $C_{23}HN_{29}O_9$ ), about 0.02% in opium. A feeble base, acting as a mild hypnotic (J. Harley), without any tendency to convulsant action. Dose,  $\frac{1}{2}$  to 1 gr. Claude Bernard attaches a high value to it.

7. *Cryptopia* ( $C_{23}H_{25}NO_5$ ), a base discovered in 1867 by Messrs. T. and H. Smith, Edinburgh, and about one-fourth as active as morphia. In large doses it causes *dilatation of the pupils*.

8. *Meconin*, or *opianyl* ( $C_{10}H_{10}O_4$ ), a neutral, non-nitrogenous substance, possessed of mild hypnotic qualities, when introduced subcutaneously (dose 1 or 2 grs.), but nearly inert when given by the stomach. Amount, about 0.01%.

9. *Papaverin* ( $C_{20}H_{21}NO_4$ ). A feeble base, forming sparingly soluble salts. It has been chiefly used as a sedative in cases of insanity; but very discrepant opinions prevail as to its action and real value. Dose, 1 to 2 grs. It is not to be confounded with a resinoid body, also termed papaverin.

10. *Pseudomorphia* ( $C_{17}H_{19}NO_4$ ). A feeble, insipid base, insoluble in water, spirit, ether, and chloroform. It has not been used in medicine. The proportion of all these components of opium is under 1%, with the exception of narcotin, morphia, and meconic acid. All the opium alkaloids include but a single atom of N, and their proportion of C increases regularly from  $C_{17}$  to  $C_{23}$ .

The other principles which have been described as procurable from opium, e. g., rhœadin, opianin, porphyroxin, laudanin, codanin, &c., are not of sufficient interest to require further reference.

TABLE OF THE DISTINCTIVE CHARACTERS OF THE CHIEF ALKALOIDS OF OPIUM.

Characters.	Morphia.	Narcotin.	Codeia.	Thebaia.	Narcein.	Papaverin.
Formula.	$C_{17}H_{19}NO_3$ .	$C_{22}H_{23}NO_7$ .	$C_{15}H_{21}NO_3$ .	$C_{19}H_{21}NO_3$ .	$C_{23}H_{29}NO_9$ .	$C_{20}H_{21}NO_4$ .
Crystals.	Needles or six-sided klinorhombic prisms.	Prisms or tufted ortho-rhombic needles.	Octahedra and ortho-rhombic prisms.	Square plates, or needles, or granules.	Four-sided rhombic prisms, or fine needles.	Scales or confused needles.
Taste.	Very bitter.	Insipid; its salts bitter.	Feebly bitter.	Acrid and styptic.	Feebly bitter.	Slightly bitter.
SOLUBILITY.						
Water.	Almost insoluble.	Almost insoluble.	Sparingly.	Insoluble.	Very sparingly.	Almost insoluble.
Rectified spirit.	Sparingly.	Sparingly.	Readily.	When hot, readily.	When hot, readily.	When hot, very soluble.
Chloroform.	Almost insoluble.	Sparingly.	Readily.	Readily.	Insoluble.	Sparingly.
TESTS.						
Nitric acid.	Almost insoluble.	Easily.	Readily.	Soluble.	Soluble.	Readily.
Sulphuric acid.	Orange red.	Yellow.	Reddish.	Yellow.	Yellow.	...
$H_2SO_4 + HNO_3$ .	Reddish violet.	When hot, blue to red.	...	Blood red.	Brown.	Violet blue.
$H_2SO_4$ + molybdate of soda (Fröhde's reagent).	Blue, then red.	Red.	When hot, blood red.	Blood red.	...	Blue, then orange.
Iodic acid.	Violet.	Green, then reddish.	Green, then royal blue.	Blood red.	Yellowish brown.	Violet.
Perchloride of iron.	Liberates iodine.	...	...	...	...	...
Iodine.	Greenish blue.	...	...	...	...	...
	...	...	...	...	Deep blue.	...



*Physiological Action.*—1. *Small or moderate doses.* The most important point to remember in connexion with opium is that both it and its alkaloids possess a distinctly double action, viz., (a) stimulant and convulsant ; (b) sedative and hypnotic. The relative development of these effects varies with the different alkaloids of opium, and moreover depends greatly on the temperament and condition of the individual, and on the dose administered. In cold-blooded animals, and also in some warm-blooded animals, convulsions, and not narcosis, are the predominant symptom of large doses. Birds, especially pigeons, enjoy a curious immunity from the narcotic action of opium, and can be poisoned only by enormous doses of morphia. The chief effects, in man, of a moderate dose, i.e. 1 to 2 grs., are, at first, quickening of the circulation, excitation of the spirits and intellectual faculties, attended with a bright eye and a sense of fulness in the head. This stage of excitement is soon followed by a state of calmness and placidity, which gradually passes into a quiet sleep. Nausea, headache, dysuria, and a sense of debility are apt to supervene on awakening from the sleep. There is thirst and also constipation, for all the usual secretions are suspended or diminished by its action, except those of the skin and breasts, although it renders the milk narcotic.

Morphia is partly decomposed in the system, but has been detected in the liver and urine of animals poisoned by it.

2. *In large or poisonous doses.* After an excessive dose, in a person not accustomed to it, the stage of excitement is brief, languor and drowsiness speedily set in, and the patient falls into a profound comatose sleep, generally free from delirium, and resembling that of apoplexy or of intense drunkenness. The pulse becomes slow, the respiration snoring, the face pale and ghastly, the pupils much contracted, the voluntary muscles relaxed and powerless, and the patient, almost completely insensible to external impressions, will die unless timely and sustained assistance be at hand.

In some rare instances of undoubted morphia poisoning the pupils have been found to be *dilated*, and convulsions are especially apt to occur in the case of children. The symptoms usually set in quickly, from within five minutes to one hour; and in fatal cases, the majority die within from six to twelve hours. When a patient survives twelve hours there is good hope of his ultimate recovery.

No characteristic *post mortem* appearances have been observed.

*Treatment of acute Opium Poisoning.*—Since there is no direct reliable chemical antidote to opium, the chief indications for treatment in case of an overdose are: 1. Evacuate the stomach by the stomach-pump or by stimulating emetics, e. g. mustard. Apomorphia would be a very suitable emetic, because it operates speedily, and can be administered hypodermically. (See Apomorphia.) 2. Counteract the lethargic and comatose state by such means as dashing cold water over the head and trunk, tickling the soles of the feet, application of mustard plasters, flagellation, gentle faradisation from the side of the neck to the diaphragm, and above all, artificial respiration diligently carried on, even when the patient seems almost beyond hope. The internal administration of strong coffee or tea, ammonia, and other stimulants, is also to be recommended. 3. The question of *physiological antidotes* to opium has been the subject of much discussion. After making all allowance for inaccurate reports of cases, and faulty evidence, it appears that enough remains to establish the point that, in *some important points, at least*, especially in reference to the heart, the administration of belladonna (or atropia) does really counteract the toxic effects of opium, and may with advantage be employed in cases of poisoning by that drug; but the atropia should be administered at first in small doses,  $\frac{1}{80}$  grain, subcutaneously, and its effects cautiously watched, lest the patient be subjected to the danger of a second poisoning.

*Abuse of Opium.*—In many countries, especially in India, China, Persia, and Turkey, and even in this country to a deplorable extent, the practice of sensual indulgence in opium, whether by eating, smoking, or drinking, is largely carried on with a view to its exhilarating and entrancing effects. Attempts have been made to palliate the vice, and to compare it favourably with dram-drinking, but nothing can be said in its defence. Sooner or later the opium eater is consumed by his vice, finds it impossible to fly from its temptations, is wrecked in body and mind, and dies prematurely in misery.

The darker side of the picture is the true one, and being less easy of detection than alcoholic stimulants, opium is sought after by the higher and more refined classes of society, some of whom fall into the snare through the incautious continuance of medicinal doses, taken for the purpose of relieving pain or other ailments.

Of late years, since the hypodermic use of morphia has become so universal, a new source of danger has arisen, and many patients, who suffer from intractable pain, glide into the fatal habit of constantly resorting to the use of the syringe for the alleviation of their sufferings; and thus, while declaring that without it life would be insupportable, they create and foster an artificial “morphia habit,” which is as pernicious to health as the degrading practices of the opium eater.

Thus, in addition to opium-eaters, we have morphia eaters (morphiophagists). Fleming mentions a case in which 20 grs. of morphia were taken at a dose, in combination with the same quantity of extract of henbane; while in another, the daily quantum rose to the almost incredible amount of 30 grm. (462·9 grs.) of morphia, when at last symptoms of poisoning set in, and death ensued with epileptiform convulsions.

*In Medicine.*—The use of opium as a medicine dates from the earliest periods, and at the present time there is no other

drug known which admits of such varied applications, or whose remedial powers are so universally acknowledged.

It would be impossible, in the scope of this article, to do more than barely mention a few of its prominent uses under two or three general heads; and the uses of morphia are included.

(a). As an *anodyne*, opium holds the highest place; and besides its value in the relief or cure of the more trivial forms of pain and neuralgia in any part of the body, the sufferings from cancer, and other incurable diseases, are more effectually mitigated by opium than by any other means.

In relation to neuralgia, the use of opium, or of morphia hypodermically, is in many cases rather palliative than curative. In the severe pain of herpes zoster the hypodermic use of morphia affords instant and permanent relief.

(b). As a *hypnotic* and nerve sedative, it is extensively used in continued fevers, in diseases of the nervous system, centric or peripheral, and in certain forms of insanity, and in diseases of the respiratory organs, e. g. phthisis.

A smaller quantity of chloroform is required to produce anæsthesia if  $\frac{1}{10}$  or  $\frac{1}{8}$  gr. of morphia be previously injected. (C. Bernard.)

(c). As an *antispasmodic*, it has been largely used in tetanus, puerperal convulsions, spasmodic asthma, whooping-cough, and in all spasmodic and painful affections of the alimentary or genito-urinary tracts, e. g. colic, and some forms of vomiting, and diarrhœa, in irritable heart, angina pectoris, &c.

(d). In acute *inflammation*, especially when affecting the serous membranes and the large joints, opium is invaluable, but it does not in general prove so useful in parenchymatous inflammations.

The tolerance of opium in acute rheumatism is very remarkable.

(e). To *check morbid secretion* or *hemorrhage*, it is much used in catarrh and influenza, diarrhœa, dysentery, and cholera, in diabetes, and hemorrhage from the lungs, uterus, or intestines.

As a modifier of unhealthy action, its value in promoting the healing of sloughing phagedæna, and chronic ulcers, especially of the lower extremities, is well attested, and was pointed out many years ago by Sir G. Blane when in the West Indies.

A multitude of other uses could be easily specified, and it is important to remember that its action is much affected by the temperament and habit of the patient, the circumstances of its administration, and a number of

*Modifying Conditions.* Of these may be mentioned:—

1. *Peculiarities of the Patient.*—Many adults do not tolerate opiates well, and women, especially when of a nervous temperament, are often highly excited by them. According to the idiosyncrasy of others, even very small doses occasion troublesome sickness and vomiting, headache and restlessness, and sleep cannot be procured.

Rarely, urticaria and a vesicular eruption have followed small doses of morphia. A much rarer peculiarity is excessive insensibility to the action of opium in persons unaccustomed to its use. Nevertheless 450 drops of the best laudanum have been taken by a gentleman unused to opium, without any other effect than some headache and constipation, and what is even more singular, his son, aged six years, took 60 m. of solution of muriate of morphia without any apparent effect (Christison).

2. *Age.*—Infants and young children are notoriously susceptible to the influence of opium. A single drop of laudanum has proved fatal to a baby, and many a child is drugged into coma by opiate nostrums, “soothing syrups,” and other patented substitutes for a mother’s watchfulness. If opiates be given to children, it should be an invariable rule not to prescribe any preparation whose strength is variable and uncertain, e. g. Syr. Papaveris.

3. *Habit and Condition of the Patient.*—Long practice enables confirmed opium eaters to tolerate enormous doses without immediately poisonous effects, and certain diseases, especially



those attended by severe pain or excitement, e. g. cancer and aneurism, cause patients to support, and even derive benefit, from huge doses of opium or morphia, which under ordinary circumstances would certainly prove fatal.

So much as 45 grs. of morphia have been tolerated by the system in a case of chronic rheumatism, and a woman suffering from metritis and rectal fistula has been known to frequently consume 24 grs. of acetate of morphia in a day.

In painful diseases the dose must be gradually and continuously increased in order to afford sufficient relief to the sufferer.

4. *Combination with other Drugs.*—This important subject may be illustrated by the diaphoretic power which opium possesses when conjoined with small doses of ipecacuanha (Dover's powder), and by the remarkable intensifying influence which morphia and chloroform mutually exercise upon each other.

5. *Peculiarities of Morphia.*—In their general effects morphia and opium closely agree, but the alkaloid is considered to be less stimulant and disturbing to the bodily functions, more liable to produce itching of the skin, difficulty in passing urine, &c. (See Morphia.)

*Contra-indications to the Use of Opium.*—As a general rule opiates are contra-indicated in depressed or comatose states with contracted pupils, in venous congestion, especially of the cerebral vessels, in certain pulmonary affections when it would be dangerous to check the bronchial secretion. They should be used with much caution in very young children, and in cases where the patient would not be conscious of their effects. Opium is stated to act prejudicially in Bright's disease, and some practitioners abstain from its use during pregnancy lest it should injure the foetus.

*Methods of Administration.*—From the manifold uses of opium and the necessity of adapting it to the condition of the patient and to the nature of the disease, the modes and forms of prescribing



opium are very numerous, and although more than two dozen preparations of opium and morphia are officinal, many others are demanded by the public, or favoured by the practitioner.

Opium is administered:—

(a). By the mouth, the most usual channel; either in the solid form as pill or powder, or in solution as liquid extract or tincture.

(b). By the rectum, often with very great advantage, as enema, or by morphia suppository.

(c). Epidermically, as Empl. Opii, Ung. Opii, or Linim. Opii. Applied in this way, merely local effects are generally observed, and constitutional influence is rarely felt.

(d). Endermically, e. g. sprinkling a blistered surface with muriate or acetate of morphia ( $\frac{1}{6}$  to  $\frac{1}{2}$  gr.)

(e). Hypodermically, by injecting a solution of one of the salts of morphia, commonly the acetate.

The subjoined table exhibits the relative strengths of the more important preparations which are used internally.

## TABLE OF PREPARATIONS.

### I. SOLID OPIUM.

Pil. Sapon. Co.	1 gr. in 5, nearly.
Pil. Plumbi .c. Opio.	1 gr. in 8.
Pulv. Ipecac. Comp. }	1 gr. in 10.
Pulv. Opii Comp. }	
Pil. Ipecac. .c. Scilla.	1 gr. in 16.
Pulv. Kino Comp.	1 gr. in 20.
Pulv. Cretæ Arom. .c. Opio. }	1 gr. in 40.
Confect. Opii.	
Trochisci.	$\frac{1}{10}$ gr. of extract in each lozenge.

### II. FLUID.

Tinct. Opii.	4 grs. to 3 i.
Tinct. Opii Ammon.	$\frac{1}{2}$ gr. to 3 i., about.

Tinct. Camph. Comp.	$\frac{1}{4}$ gr. to. $\zeta$ i.
Extr. Opii Liq. }	22 grs. Extr. Opii to $\zeta$ i., i. e. a little stronger than laudanum.
Vinum Opii. }	

## III. MORPHIA.

Liq. Morph. Acet. }	4 grs. to $\zeta$ i.
Liq. Morph. Hydrochl. }	
Suppos. Morphicæ.	$\frac{1}{2}$ gr. in each.
Trochisci Morphicæ. }	$\frac{1}{8}$ gr. in each.
Troch. Morphicæ et Ipecac. }	

The non-official preparations which are in most demand are :—

1. Solution of bi-meconate of morphia (Squire, 1839). Dose, same as Tinct. Opii.

2. Battley's\* *Liq. Opii Sedativus*. Stronger than laudanum. Dose, 5 to 20 m.

3. Black drop, an acetic solution of opium. Dose, 4 to 10 m.  
1 m. = 4 m. Tinct. Opii.

4. Nепenthe (Ferris). Dose, same as laudanum.

5. Chlorodyne. For its true formula, see Chloroform.

## OS USTUM.

Impure phosphate of lime mixed with carbonate of lime. Used only in preparing the phosphates of calcium and sodium. A similar residue is obtained by calcining horn (*Cornu ustum*). See p. 179.

## OVI VITELLUS.

Egg shells were formerly used in medicine as an antacid in diarrhœa, on account of the carbonate of lime of which they largely consist, but they have long since fallen into disuse.

\* Battley was a manufacturing druggist in Fore-street, London, 50 years ago. Dr. Paris mentions that this preparation is indebted to Wedelius or Le Mort for its origin.

The white of egg which contains  $12\frac{1}{2}\%$  of albumen is officinal (see Albumen Ovi, p. 79), as well as the yolk, Vitellus Ovi. The latter, which forms an opaque emulsion when agitated with water, is only used pharmaceutically for emulsifying or suspending insoluble substances in water, such as balsams, turpentine, oils, &c. It contains 3% of albumen, 30% of yellow fat, and 14% of casein.

### OXYMEL.\*

Consists simply of honey medicated by the addition of about  $\frac{1}{4}$  part of the diluted acetic acid.

Occasionally added to gargles, or used as a vehicle for expectorant medicines.

### OXYMEL SCILLÆ.

A very superfluous preparation, since its composition and uses are essentially the same as those of Syrupus Scillæ.

### PAPAVERIS CAPSULÆ.

*Origin.*—In England the white or opium poppy, *Papaver somniferum*, N. O. Papaveraceæ, is cultivated chiefly for its capsules.

*Characters.*—They vary a good deal in size and shape, and while those grown in this country are globular or spheroidal, another variety of poppy yields long or nearly cylindrical capsules. The style is absent, and the ovary is crowned by the diverging rays of the sessile stigma, which correspond to a number of incomplete internal partitions to which the numerous oily seeds adhere in the recent state. The capsules contain a minute amount of morphia and the other opiate principles; the seeds are quite devoid of them.

\* 'Οξύς, acid; μέλι, honey.

*In Medicine.*—Poppy head stupe (Decoct. Papav.) is a favourite emollient and anodyne application in ophthalmia, sprains, and rheumatic affections, and the Syrup and Extract are sometimes used internally as sedatives and hypnotics, especially with children, but they are too feeble and irregular in strength to be recommended.

### PAREIRÆ\* RADIX.

*Origin.*—Some confusion has existed for more than 100 years as to the true origin of Pareira root, and it is ascribed in the Pharmacopœia to Cissampelos Pareira, N. O. Menispermaceæ. But Mr. Hanbury has recently shown that this is erroneous, and that the true Pareira brava is the root of Chondodendron tomentosum. The structure of the root and stem of Cissampelos Pareira shows no concentric rings. Nothing is really known of the botanical origin of the laminated officinal drug, beyond the fact that the structure of the wood is that of the Menispermaceæ. Of late years even this kind has become rare, and its place has been taken by specimens of concentrically marked wood, which is tasteless and completely devoid of medicinal power. Mr. Hanbury strongly advocates returning to the use of Chondodendron, which is the plant on which the reputation of Pareira brava was originally founded. (*Pharm. Journal*, August 9, 1873).

*Characters.*—The pieces of the root vary in size from the thickness of a finger to that of the arm, and it is distinguished from other roots by the concentric rings and medullary rays seen on cross section. It contains an alkaloid, *cissampeline* or *pelosine* (buxin or bebeerin) ( $C_{18}H_{21}NO_3$ ), which is isomeric with codeia.

*In Medicine.*—It was introduced into practice nearly 200 years ago, and is chiefly employed in the treatment of chronic in-

\* A Spanish term.

flammation of the bladder. It seems to allay the irritability of that organ and to check the profuse mucous secretion. Often given in association with buchu and hyoseyamus, and generally prescribed in the Decoction, dose,  $\mathfrak{z}\text{i}$ . to  $\mathfrak{z}\text{ij}$ .

### PEPSIN.\*

As a remedial agent, the stomach of certain of the lower animals has been employed under three forms:—

1. The fresh gastric juice; not used now.
2. Rennet, an infusion of the dried stomach; and
3. Pepsin, a peculiar nitrogenous principle, which has been recently introduced into the Pharmacopœia.

*Preparation.*—On the officinal process, it is necessary only to remark, that the greatest care must be taken that the rennet bag of the animal selected (pig, sheep, or calf) be perfectly fresh, and that the temperature during evaporation does not rise above  $100^{\circ}$  F., because pepsin is decomposed by a heat of  $120^{\circ}$ , and then loses its digestive properties.

*Characters and Tests.*—Neither the preparation obtained by the officinal process, nor any of the articles sold under the title pepsin, can justly be considered as a pure principle, and no chemical formula can therefore be assigned to pepsin. The only reliable test of its quality is its solvent action, when acidulated, upon coagulated albumen or fibrin. One part of pepsin should be capable of dissolving, within four or five hours, fifty parts of hard boiled white of egg in thin slices. The quality of commercial pepsin varies greatly, and many of the specimens sold under the name are perfectly worthless. The best pepsin, according to the experiments of Pavy and Tuson, is that prepared by Bullock and Reynolds, from Dr. Beale's formula. Boudault's contains a large proportion of starch.

\* Πέπρω, to digest.

*In Medicine.*—The sole use of pepsin is as an artificial aid to digestion, whenever the gastric juice is not produced in quantity or quality sufficient to meet the demands made upon it. Although there can be little doubt that its claims have often been over-rated, the therapeutic use of pepsin is, *a priori*, not unreasonable, and there is sufficient evidence to establish its real value in certain cases.

For example, in the dyspepsia following chronic gastritis, or that attendant on convalescence from fever; in exhausting diseases, and in protracted diarrhœa consequent on indigestion, the administration of pepsin is to be recommended. It has also rendered good service in the obstinate vomiting of pregnancy.

Pepsin may be given in powder, solution, or wine, or on bread and butter; and there is no incompatibility between it and the bitter tonics frequently employed in dyspeptic cases.

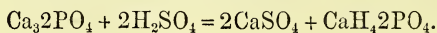
Five grains may be taken immediately before meals, and a little hydrochloric acid should always be combined with the dose of pepsin.

## PHOSPHORUS.\*

P=31.

*Origin and Preparation.*—Phosphorus occurs in the seeds of many vegetables, and in the nervous system, urine, blood, and bones of the higher animals. It is now always extracted from bone ash (Os Ustum), as first suggested by Scheele, and most readily from the ash obtained by calcining the bones of sheep. The process consists of two steps:—

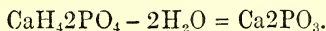
1. The bone ash is digested with diluted sulphuric acid, whereby most of the lime is precipitated as calcic sulphate, while superphosphate of calcium remains in solution—



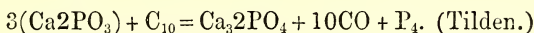
\* Φως, light; φέρω, to bring.



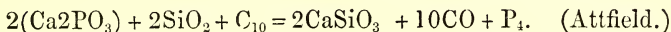
2. By evaporation, the acid solution of superphosphate of calcium loses water, and leaves a residue consisting chiefly of calcic metaphosphate ( $\text{Ca}_2\text{PO}_3$ ),



This latter salt is then heated with charcoal—



or, if distilled with charcoal and sand—



The liberated crude phosphorus is collected in a receiver filled with cold water, and is purified by melting it under water, and agitating it with a mixture of sulphuric acid and bichromate of potassium, in order to remove any traces of oxide or other impurities. The pure phosphorus deposits as a colourless oily layer, and is finally cast into sticks in cylindrical glass moulds.

*Characters and Tests.*—Commercial specimens of phosphorus occur either in sticks or cakes. Phosphorus, although colourless and translucent when recent, gradually becomes coated with a white layer, formed of numerous microscopic crystals. It often acquires a yellow or even red colour, and occasionally gains a fine scarlet hue on the exterior, due to one of the numerous allotropic forms of phosphorus. The white vapour which phosphorus emits on exposure to the air consists of phosphorous anhydride,  $\text{P}_2\text{O}_3$ ; the dense white fumes produced by rapid combustion are phosphoric anhydride,  $\text{P}_2\text{O}_5$ . Phosphorus is so inflammable that it must be kept under water, and it should be handled with great caution. The best solvent for it is bisulphide of carbon,  $\text{CS}_2$ ; and “Fenian fire” was such a solution, containing 70% of P. Under certain circumstances, viz., by exposure to sunlight, or to artificial light, or to heat in closed vessels, phosphorus is converted into an allotropic form, the *red* or *amorphous phosphorus*,

which is not acted on by the air, is insoluble in the ordinary solvents for phosphorus, and is not so poisonous. When volatilised, it reverts to the state of common phosphorus.

*In Pharmacy.*—By oxidation with nitric acid, phosphorus yields Acid. Phosph. Dil., and by treatment with slaked lime, it yields Calcis Hypophosphis. For dispensing purposes, phosphorus is easily granulated by placing some of it in a stoppered bottle with a little proof spirit, immersing the bottle in warm water so as to melt the phosphorus, and then shaking briskly until cold.

*In Medicine.*—In large doses, i.e. 1 gr. and upwards, phosphorus acts as a violent irritant poison, producing intense inflammation of the stomach and bowels, obstinate pain and vomiting, jaundice, and convulsions. After death, fatty infiltration (steatosis) of the liver, kidneys, and muscles is found.

Magnesia, suspended in water, seems to have some value as an antidote; but the most reliable means of counteracting the poison is that recently proposed by M. Andant, viz. the internal administration of oil of turpentine.

The turpentine forms with the phosphorus a white, spermaceti-like combination, terebintho-phosphoric acid, which is comparatively inert; and several lives have been saved by this treatment in France.

Those who work with phosphorus, e. g. the manufacturers of lucifer matches, are well known to be liable to anæmia and cachexia, with necrosis of the maxillæ due to periostitis. If the red or amorphous phosphorus be employed, no poisonous corroding fumes are given off.

Small doses of phosphorus act as a powerful stimulant, and tend to irritate especially the kidneys and genital organs. On theoretical grounds, as being an ingredient of the bones and nervous centres, phosphorus has been proposed in a number of diseases, viz. impotency, certain cases of paralysis, &c. Possibly its action on the nervous system is analogous to that of iron

on the blood. Delpech has recommended phosphorus as a cure for the nervous cachexia and sexual debility observed among workers in vulcanised india-rubber, and due, probably, to the bisulphide of carbon used in the manufacture. Of late years, phosphorus has been frequently administered in locomotor ataxy, and seems to have effected good in some cases of this grave affection.

Recently, on the ground of its chemical analogies, Dr. Broadbent has proposed phosphorus as a substitute for arsenic in the treatment of diseases of the skin and other affections which have proved rebellious to the latter drug.

*Administration.*—There are now two officinal formulæ for the exhibition of free phosphorus, viz. Oleum Phosphoratum, a solution of phosphorus in (fixed) oil of almonds; and Pilula Phosphori. The phosphorised oil is best prescribed in gelatin capsules, prepared so as to contain  $\frac{1}{30}$ ,  $\frac{1}{20}$ , or  $\frac{1}{10}$  gr. of phosphorus in each.

Other modes of administration are, pills made by incorporating phosphorus with suet; solutions in chloroform or cod liver oil; phosphide, and chloro-phosphide of zinc.

The average dose of phosphorus to commence with is  $\frac{1}{30}$  gr.; but its effects should always be carefully watched, lest gastric irritation or other inconvenience be caused.

### PHYSOSTIGMATIS\* FABÆ.

*Origin.*—Certain poisonous vegetables have long been known to be in use among the natives of the west coast of Africa as a superstitious ordeal to determine the guilt or innocence of individuals accused of witchcraft. One of these, the ordeal bean of Calabar, was introduced into notice in Edinburgh by Dr. Daniell,

\* *Φυσάω*, to inflate, and *στίγμα*; from the remarkable hooded appendage of the stigma.

in 1846, and, after subsequent careful examination of the plant raised from seed, Dr. Balfour named it *Physostigma venenosum*, N. O. Leguminosæ.

It is a large climbing plant, sometimes attaining a length of fifty feet, bears delicate pink flowers and a brown pod or legume, which contains several seeds.

*Characters.*—The seeds are readily known by their dark brown colour, oblong kidney shaped form, by the furrow along the convex margin, and their white, hard interior.

Notwithstanding their almost universally deadly properties, the beans are occasionally perforated from the attacks of an insect. The most important constituent of the seed is an extremely poisonous alkaloid, *eseria* (*physostigmia*)  $C_{15}H_{21}N_3O_2$  which occurs only in the cotyledons.

This alkaloid is difficultly crystallisable, and is easily decomposed. It is insipid itself, and forms tasteless salts.

*Physiological Action.*—In this country attention was first called to its physiological effects by Sir R. Christison, who experienced serious results from swallowing a dose of twelve grains of the bean. The prominent symptoms in his case were vertigo, a sense of torpidity and extreme prostration, syncope, and notwithstanding the feebleness of the heart and pulse, they were tumultuously irregular, but the mental faculties were quite unimpaired, and the mind remained active all through. Its precise physiological action has been thoroughly studied by Dr. T. R. Fraser, and from his experiments on the lower animals the following results follow :

1. It acts on the spinal cord by destroying its power of conducting impressions, but does not seem at first to interfere with the spinal nerves or with the cerebrum. In short, it produces a complete loss of motility and of the reflex activity of the cord, as well as complete loss of sensibility to pain, while tactile sensibility and the so called muscular sense are preserved up to the time of death.

2. It may produce death, either (*a*) by muscular paralysis, extending gradually to the respiratory apparatus, *asphyxia*; or (*b*) by paralysis of the ganglia of the heart, *syncope*.

3. After a time, the motor nerves are paralysed, from their peripheral extremities centrally, but the afferent or sensory nerves are left untouched.

4. It produces paralysis of both striped and unstriped muscular fibre.

5. It acts as an excitant of the secretory system, especially of the alimentary mucous glands.

6. Its most important topical effect is contraction of the pupil (myosis) when applied to the eye, and in man this is attended with a feeling of ciliary tension, myopia (Argyll Robertson), astigmatism (Bowman), and often with conjunctival congestion, supraorbital pain, and twitches of the orbicularis oculi muscle. Four drops of a solution of eseria, 1 in 1000, will induce myosis.

In the medico-legal investigation of Calabar bean poisoning the most conclusive evidence is afforded by applying the "physiological test," viz. observing the contraction of the pupil produced by dropping in a solution of the suspected substance into the eye of a rabbit. The paralysing effects are best tested upon frogs or small birds, which latter however do not manifest myosis through local application. In cats and dogs, and even in the human subject, *dilatation* of the pupil sometimes ensues upon the hypodermic injection of the drug. Within six hours after death the myotic action can be produced by local application as during life.

In cases of *poisoning*, the best treatment would be to empty the stomach promptly by emetics or the stomach pump, to give strong coffee (i. e. tannin), and diffusible stimulants, and as a physiological antidote, to administer small doses of atropia.

*In Medicine.*—From its active qualities much might be expected of Calabar bean therapeutically, but as yet its internal use has not been followed by very striking results, except in two

instances, viz. as an antidote to strychnia poisoning, and in acute traumatic tetanus, in which the results obtained by Dr. Eben. Watson and others afford much encouragement.

It has also been recommended in chorea, various neuralgic affections, erysipelas, delirium tremens, &c.

But it is as a topical agent that its utility is best shown as a valuable remedy; in certain ophthalmic cases it is unique. It serves, e.g. to counteract the effects of belladonna or atropia on the eye, to diminish the amount of light admitted to the eye in certain cases of disease, to stimulate the iris to contraction in cases of paralysis of the third nerve from diphtheria or other causes, and to guard against prolapse of the iris in penetrating ulcers or wounds of the cornea. Its myotic effects are more transient than the mydriatic effects of belladonna.

*Administration.*—For use internally,  $\frac{1}{16}$  to  $\frac{1}{4}$  grain of the spirituous extract by the mouth, or one-third less, hypodermically. A tincture of corresponding strength has been employed. The dose of eseria, internally, is from  $\frac{1}{50}$  to  $\frac{1}{40}$  grain; subcutaneously,  $\frac{1}{70}$  grain.

For local application, a solution of the extract in glycerin should be used, so that one minim will contain the active ingredients of two or four grains of the bean. Small squares or discs of calabarised paper or gelatin afford a convenient means of applying the drug to the conjunctiva.

### *PILULÆ.\**

Pills are small globular masses of a size convenient for swallowing without being chewed, and are usually from 3 to 5 grs. in weight. Minute pills, scarcely larger than a pin's head, are popular in France under the name of *granules*. Pills should be sufficiently firm and cohesive to retain their form and condition, and

\* *Pila*, a ball.



they offer a very convenient and favourite mode of administering medicines which are unpleasant to the taste or smell (e. g. assa-fœtida), or are heavy and insoluble in water (e. g. calomel), or whose dose is not too bulky, or substances which are not intended to act topically or immediately (aloës).

They are coated with a variety of substances, with the view of preserving them from change, or concealing their disagreeable qualities, viz., gelatin, collodion, balsams, resins, albumen, wax, &c. In order to prevent them sticking together, they are generally dusted over with some vegetable powder (lycopodium, liquorice, &c.), or with a mineral powder (e. g. French chalk, magnesia, &c.), and they may be enveloped in gold or silver leaf.

A *bolus* is simply a very large, soft pill. For obvious reasons the introduction of bodies which operate only in large doses, or require bulky excipients, or deliquescent ( $K_2CO_3$ ), and efflorescent substances ( $Na_2CO_3$ ), into pills, should be avoided, and the practical details of pill dispensing require considerable pharmaceutical skill for their proper execution.

The more common active ingredients of pill masses are gum-resins, extracts, resins, and vegetable or mineral powders, which may be prescribed in suitably small doses. The excipient of the pill will be dry (bread crumb, dry extracts, &c.), or moist (water, oils, syrups, spirit, gum, soft extracts, and confections), according to the nature of the other ingredients, its chief object being to impart a suitable consistence to the pill mass.

Pills keep much better in well corked bottles than in boxes. Some pill masses become so hard and dry by keeping, that they are rendered unfit for use.

There are twenty-two officinal pills, six of which were not in the Pharmacopœia of 1864. Most of them are purgative in their action, e. g. the aloetic (of which there are nine), and those of colocynth, gamboge, scammony, and rhubarb; some are tonic, e. g. Pil. Quiniæ, and the chalybeate pills; others expectorant,

e. g. Pil. Ipecac. c. Scilla; or sedative, e. g. Pil. Plumbi c. Opio; or mercurial, Pil. Hydrarg. Subchlor. Co.

The average dose of a pill mass is from 5 to 10 grs.

### PILULA ALOES BARBADENSIS.

In the aloetic pills the soap not only serves to impart a proper consistence, but is thought to render the aloes more soluble, and less liable to irritate the rectum. Contains 1 part of aloes in 2.

### PILULA ALOES ET ASSAFŒTIDÆ.

A useful carminative purgative, adapted to cases of costiveness, attended with flatulence. Contains 1 part each of aloes and assafœtida in 4.

### PILULA ALOES ET FERRI.

A useful formula for a tonic-aperient pill. Contains 1 in 7 of sulphate of iron, and 1 in 5 of aloes. The dried sulphate of iron should be the form employed.

### PILULA ALOES ET MYRRHÆ.

Commonly called Rufus' pill. A very old formula, dating from the second century, and was described by Rhazes. Contains 1 in 3 of aloes. Much employed as a warm, stimulant cathartic, and it is credited with emmenagogue virtues.

### PILULA ALOES SOCOTRINÆ.

A useless formula, for it differs from Pil. Aloes Barbadensis only in containing oil of nutmeg as a flavouring ingredient, instead of oil of caraway. There is no real difference in action between the two kinds of aloes.

Holloway's pills are stated to consist of Socotrine aloes, rhubarb, pepper, saffron, and sulphate of soda (Dorvault).

## PILULA ASSAFŒTIDÆ COMPOSITA.

Contains about 1 in 3 of each of the active ingredients. This pill becomes very hard by keeping. It is often prescribed as a carminative laxative, and antispasmodic, in chlorotic and hysterical cases.

## PILULA CAMBOGLÆ COMPOSITA.

Contains 1 of gamboge in 6. An active and useful purgative.

## PILULA COLOCYNTHIDIS COMPOSITA.

Contains  $\frac{1}{6}$  of colocynth, and  $\frac{1}{3}$  each of aloes and scammony. It includes the same active ingredients as Extr. Coloc. Co., from which it differs chiefly in containing about twice as much scammony. In England it is vulgarly known as "Pil. a coshy," or "Pil. cochy." (From *coccia*, seeds, a term used in the seventh century for pills.) The sulphate of potash, from its hardness, serves to promote the more complete division of the vegetable drugs.

This pill is an active cathartic in the dose of 5 or 10 grs.

## PILULA COLOCYNTHIDIS ET HYOSCYAMI.

Differs from the last pill mass only in the addition of one-third of its weight of extract of hyoscyamus.

The henbane is considered to prevent or mitigate the griping tendency of the colocynth without interfering with its purgative action. Sometimes called "Christison's pill."

## PILULA CONII COMPOSITA.

Contains about one part of ipecacuanha in six.

Intended as a sedative expectorant pill, but the extract of hemlock is a very unreliable preparation (see *Conii Folia*).

## PILULA FERRI CARBONATIS.

Contains about one-third of  $\text{FeCO}_3$ , and in its composition may be considered as a substitute in the solid form for Griffith's mixture (Mist. Ferri Co.). It is sometimes known as Vallet's ferruginous pill. The sugar in the saccharated carbonate of iron is for the purpose of hindering the oxidation of the iron salt.

Blaud's pills contain dried sulphate of iron and carbonate of potash, made up with gum and syrup.

## PILULA FERRI IODIDI.

Contains nearly 1 gr. of  $\text{FeI}_2$  in three. Since iodide of iron is so unstable, the pill should be prepared when required by direct union of iodine and iron. It is preserved as much as possible from the effects of oxidation by means of the sugar with which it is triturated. But still this pill mass will not bear exposure, for it crumbles down and iodine is evolved. M. Blancard has prepared and coated pills of ferrous iodide so carefully that they remain unchanged for several years.

For its uses, see Ferri Iodidum.

## PILULA HYDRARGYRI.

Contains one part of metallic mercury, partially oxidised, in three. Commonly known from its colour, as *blue mass* or *blue pill*. The trituration of the mercury requires to be long continued; and on the large scale, the mass is usually prepared by steam machinery. This preparation slowly changes colour by keeping, and assumes a dull green or reddish tint.

*In Medicine.*—A mild mercurial, and less liable than some of the other preparations to cause irritation or purging. If diarrhoea be excited, the addition of a little opium will

check it. A full dose, 5 or 10 grs., is sometimes ordered as a cathartic.

### PILULA HYDRARGYRI SUBCHLORIDI COMPOSITA.

Contains 1 gr. of calomel in five. Commonly known as *Plummer's\* pill*, and frequently prescribed under the abbreviated title, *Pil. Calom. Co.* (not to be confounded with *Pil. Coloc. Co.*). According to Vogel some  $\text{HgS}$  is formed by mutual reaction between the calomel and sulphide of antimony.

None of its ingredients occur in any other pill mass, and castor oil, on account of its viscidty, is employed to bind together the three dry powders contained in it.

This preparation is much used in the treatment of chronic rheumatism and syphilis, and is a mild form of mercurial.

The principal action of the pill is due to the calomel, and not to the sulphurated antimony.

Dr. Paris ascertained that if this pill be enveloped in magnesia, partial decomposition ensues, and some chloride of magnesium is formed.

### PILULA IPECACUANHÆ CUM SCILLA.

Contains 1 part of opium in 16, and 1 each of squill and ammoniacum in 7.

A stimulating expectorant combination applicable to cases of chronic bronchitis.

### PILULA PHOSPHORI.

The officinal process for the preparation of this pill is unsatisfactory. The pill mass may be kept immersed in water in the

\* This preparation was originally introduced to the notice of the profession by Dr. Andrew Plummer, Professor of Medicine in the University of Edinburgh. (Edin. Med. Essays and Obs, I., Art. vi.)

same way as phosphorus is preserved. This pill contains 1% of phosphorus, i. e. 3 grs. =  $\frac{1}{33}$  gr. of the metalloid.

### PILULA PLUMBI CUM OPIO.

Four grs. of this pill mass contain three of acetate of lead, and gr. ss. of opium.

A useful sedative astringent combination, much used in the treatment of obstinate diarrhœa, phthisical sweats, and cholera.

### PILULA QUININÆ.

This pill contains 3 grs. of sulphate of quinia in 4, and is a useful formula for the administration of quinine.

### PILULA RHEI COMPOSITA.

Contains 1 of rhubarb in 4, and 1 of aloes in 6.

A popular aperient, much used in simple constipation. The pilular form is the least nauseous form in which rhubarb can be taken.

It has been observed that Pil. Aloes Barb., Pil. Aloes Socotr., Pil. Colocynth. Co., and Pil. Rhei Co., are each flavoured with a different volatile oil, whereby the odour may assist in distinguishing them from each other.

### PILULA SAPONIS COMPOSITA.

This preparation contains about 1 of opium in 6, and is a convenient formula for the administration of opium.

### PILULA SCAMMONII COMPOSITA.

A non-aloetic cathartic mass. The combination with soap is said to render the purgative resins more effective.



## PILULA SCILLÆ COMPOSITA.

Contains 1 of squill in 5, and 1 of ammoniacum in 6.

A stimulant expectorant compound suitable to chronic bronchial affections.

It is liable to spoil by keeping, and it should therefore be recently made.

## PIMENTA.\*

*Origin.*—The *Eugenia*† *Pimenta*, N. O. Myrtaceæ, is an ever-green, aromatic tree, a native of the West Indies and South America. The fruit, sometimes termed *Jamaica pepper*, is gathered while yet green, and is dried in the sun. If allowed to ripen fully, it loses its aromatic warmth, and acquires a flavour analogous to that of juniper. The fruits of bael and pepper are likewise employed in the unripe state.

*Characters.*—The small, round, rough berries are characterised by the crown at the summit, formed by the persistent adherent rim of the calyx. This is 4-parted when entire, but is almost always reduced to the state of a mere ring from mutual friction of the fruits. Their odour and flavour resemble those of a mixture of cinnamon, cloves, and nutmeg, and hence their popular name of *allspice*. The only important constituent is a volatile oil, which is heavier than water, and forms from 1 to 4% of the berries.

*In Medicine.*—Allspice is more used as a condiment than for any other purpose, and is simply a warm aromatic stimulant and carminative, which may be added to other medicines, such as

\* *Pimienta*, the Spanish fir.

† Named in compliment to Prince Eugene of Savoy.

tonics and purgatives. Associated with ginger in Syr. Rhamni, it serves to correct the griping qualities of the buckthorn.

### PIPER\* NIGRUM.

*Origin.*—The pepper plant, *Piper Nigrum*, N. O., *Piperaceæ*, is a perennial, bearing small white flowers clustered thickly on a cylindrical spike. The flowers are succeeded by globular berries, which become red when ripe. It grows freely in India and various parts of the East.

*Characters.*—As in the case of *pimenta*, the fruit is collected in the *unripe* state, because it is then more pungent and aromatic. When dried, the berries are brownish black and wrinkled. They closely resemble cubebs, from which however they can be distinguished by the absence of a fruit stalk. *White pepper* is the ripe berry of the same plant, deprived of its skin by friction, after maceration in water, and afterwards dried in the sun.† The two important constituents of pepper are: (a) an oleo-resinous mixture; and (b) 2 to 3% of a pale yellow crystalline alkaloid of feeble basic powers, called *piperin* ( $C_{17}H_{19}NO_3$ ), which is isomeric with morphia.

*In Medicine.*—Pepper is a warm, carminative stimulant, and is more in use as a condiment than as a medicine. Its effects are somewhat similar to those of *copaiba* and *cubebs*. The Conf. *Piperis* (Ward's paste) has long had a reputation in the treat-

\* Πέπερι, from Πέπτω, to concoct; because it promotes digestion by its stimulating properties.

† Through ignorance of the fact that black and white pepper are derived from the same plant, the directors of the H. E. I. C. once fell into a ludicrous mistake. They wrote out to Bencoolen in their usual magniloquent style, directing their servants to "pay more regard in future to the planting and cultivation of white pepper and not to increase the number of black pepper plants." After they found out their mistake they were always very considerate to their Bencoolen establishment.

ment of piles. Pepper occasionally causes an urticarious eruption on the skin. Piperin has been employed as a substitute for quinine in the treatment of intermittent fever, but appears to be uncertain in its action. Externally, pepper has been used as a rubefacient, and in the treatment of eruptions of the scalp.

## PIX BURGUNDICA.

*Origin.*—Burgundy pitch is a solid turpentine or oleo-resinous exudation from the stem of the Norway Spruce, *Abies excelsa*, N. O. Coniferæ. The term “Thus” was originally applied to the exudation of this tree, but is now restricted to the concrete American turpentine. (See *Thus Americanum*).

It is freed from impurities by melting and straining. It was called Burgundy pitch from the province of that name in the east of France; but this is a misnomer, for the resin was never collected in that district, but is derived from Finland, Baden, and Austria. It is *not* imported from Switzerland, as the Pharmacopœia states.

*Characters.*—A yellow or brown solid, resembling frankincense, *Thus Americanum*. True Burgundy pitch is often counterfeited by resin, rendered opaque by the incorporation of water, and usually coloured by palm oil. It should be almost entirely soluble in twice its weight of glacial acetic acid. (Hanbury).

*In Medicine.*—Only used externally as a rubefacient, and as an ingredient of various Emplastra.

## PIX LIQUIDA.

*Origin.*—Tar is a bituminous liquid, or impure turpentine, obtained by the aid of heat from the wood of various species of pine, especially *Pinus sylvestris* and *P. palustris*, N. O. Coniferæ.

*Pitch* (*Pix nigra*) is the solid residue left on the distillation of wood tar, but it is not recognised in the Pharmacopœia.

Three kinds of tar are known, viz: 1. Natural mineral tar, e. g. Barbadoes tar; 2. Artificial mineral tar, e. g. coal tar; 3. Wood tar.

*Characters.*—The sensible properties of tar are too well known to need any further reference. In constitution wood tar is very complex, and contains a large number of distinct principles, one of which, viz. true *creasote*, is officinal, and is of considerable importance.

*In Medicine.*—In its stimulant properties tar agrees with other turpentine, and, although much credit was at one time claimed for *tar water*, it is seldom used now. Tar pills are occasionally prescribed in some obstinate skin diseases, e. g. psoriasis.

Externally, tar is really a serviceable application, and finds employment chiefly in troublesome cases of ringworm, chronic psoriasis, and obstinate indurated scaly eczema. It should be freely applied in the form of Ung. Picis Liq., and be washed off in a few hours by warm soap and water or carbolic soap. The free external use of tarry preparations will occasionally induce black stools and a dark colour of the urine.

*PLUMBUM.*

Pb = 207.

*TABLE OF THE COMPOUNDS AND PREPARATIONS  
OF LEAD IN THE PHARMACOPŒIA.*

1. Acetate.	$\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2, 3\text{H}_2\text{O}.$
Pil. Plumbi c. Opio.	3 parts in 4.
Suppos. Plumbi Co.	3 grs. in each.
Ung. Plumbi Acet.	1 part in 38.
2. Carbonate.	$2\text{PbCO}_3, \text{Pb}_2\text{HO}.$
Ung. Plumbi Carb.	1 part in 8.
3. Iodide.	$\text{PbI}_2.$
Empl. Plumbi Iod.	1 part in 9.
Ung. Plumbi Iod.	1 part in 8.
4. Nitrate.	$\text{Pb}_2\text{NO}_3.$
5. Oxide.	$\text{PbO}.$
6. Subacetate, Solution of.	$\{ \text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2, \text{PbO} ;$
Liq. Pl. Subacet. Dil.	$\{ 18\cdot50 \text{ grs. } \text{Pb}_2\text{C}_4\text{H}_6\text{O}_5 \text{ in } 5 \text{ i.}$
Ung. Pl. Subacet. Co.	$0\cdot23 \text{ grs. } \text{Pb}_2\text{C}_4\text{H}_6\text{O}_5 \text{ in } 5 \text{ i.}$



*Origin.*—Various compounds of lead (oxide, phosphate, carbonate, chromate, &c.), occur in nature, but the commonest ore and the one from which lead is chiefly extracted is *galena*, a glistening grey sulphide,  $\text{PbS}$ , from which the metal is obtained by roasting it in a current of air.

*Characters.*—The general characters of metallic lead are familiar to everyone from its extensive use in the arts and manufactures. By exposure to moist air an oxy-carbonate is formed on the surface ; and water, especially when pure and soft, is contaminated by transmission, through leaden pipes. In the case of hard or impure water, the carbonates and sulphates in the

water exercise a protective influence by forming an insoluble thin crust on the metal. The sp. gr. is 11.4, and it melts at about 612°. When heated in the air it combines with oxygen, and is converted into a yellow powder (massicot), or into brick red scales (litharge),  $\text{PbO}$ , the oxide from which most of the lead compounds are directly or indirectly prepared. By continued heat, red lead (minium) is produced,  $\text{Pb}_3\text{O}_4$ . All the soluble compounds of lead present, when tasted, the singular combination of astringency and sweetness.

*Chemical Relations.*—The atom of lead is tetrad,  $\text{Pb}^{\text{iv}}$ , i. e. it is capable of combining with four atoms of a monad or monatomic radical, e. g. plumb-ethyl,  $\text{Pb}(\text{C}_2\text{H}_5)_4$ ; but in all its officinal compounds it acts only as a dyad,  $\text{Pb}^{\text{ii}}$ , e. g.  $\text{PbI}_2$ ,  $\text{PbO}$ , &c.

Hydrochloric acid and dilute sulphuric acid do not perceptibly affect lead, but concentrated sulphuric acid attacks it, disengaging sulphurous anhydride, and forming sulphate of lead. The best solvent for lead is nitric acid.

Lead has a great tendency to form basic salts, e. g. subacetate, and its solutions are prone to absorb  $\text{CO}_2$  from the air. These subsalts have a marked affinity for, and form insoluble compounds with, gummy (see *Acaciæ Gummi*), mucilaginous, and vegetable colouring matters, and are frequently used in chemistry to effect their removal from solutions. To detect lead in solution, e. g. in water, or in urine, &c., the three best tests are :—

1. Sulphuric acid and soluble sulphates cause a *white* precipitate of sulphate of lead, insoluble in dilute acids, e. g.  $\text{Pb}_2\text{NO}_3 + \text{H}_2\text{SO}_4 = \text{PbSO}_4 + 2\text{HNO}_3$ .

2. Iodide or chromate of potassium gives a *yellow* precipitate of iodide or chromate of lead, e. g.  $\text{Pb}_2\text{NO}_3 + 2\text{KI} = \text{PbI}_2 + 2\text{KNO}_3$ .

3. Sulphuretted hydrogen or sulphide of ammonium gives a *black* precipitate of sulphide of lead; brown, if only a minute

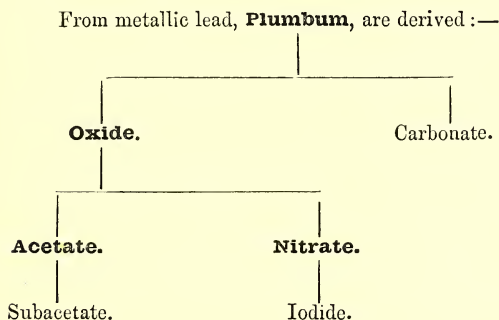


proportion of lead be present, e. g.  $\text{Pb}_2\text{NO}_3 + \text{H}_2\text{S} = \text{PbS} + 2\text{HNO}_3$ .

Hence, lead paper (i. e. paper soaked in solution of acetate or subacetate of lead) is a delicate test for sulphuretted hydrogen. (see *Ac. Aceticum*).

*In Pharmacy.*—Metallic lead is not used directly in the preparation of any of its compounds, except the oxide and carbonate.

### GENEALOGICAL TABLE OF THE LEAD COMPOUNDS.



*In Medicine.*—The general effects of the compounds of lead combine those of a sedative and astringent, and their influence on the circulation is shown by their reducing the action of the heart and arteries. The salts of lead are among the few astringents admissible during the presence of inflammation.

Externally, the preparations of lead are much used to reduce inflammation, as mild stimulants, and for restraining excessive discharges.

The gradual and continued introduction of lead into the system with the food or drink, by trade or occupation, or even occasionally through medicinal use, induces various poisonous

effects which collectively constitute saturnine\* poisoning, or plumbism. The most prominent of these are :—

1. Dyspepsia, lead (painters') colic, or *colica pictorum*, and other forms of neuralgia, attended with obstinate constipation. There is usually also developed a blue line (Burton) along the edges of the gums around several or all of the teeth, and a sallow tint of skin. The blue line is due to sulphide of lead.

2. Local atrophic paralysis, commonly affecting the upper extremities only, and chiefly the extensor muscles (wrist-drop); but sometimes engaging the legs and muscles of the trunk.

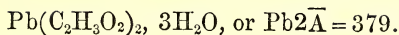
3. Head symptoms, e. g. vertigo, epileptiform convulsions, and coma. These are, fortunately, more rare.

The lead appears to be introduced into the circulation through the agency of the alkaline chlorides in the alimentary canal, and the remedy that is most efficient in aiding the elimination of lead from the system is iodide of potassium (Melsens). The colic is best relieved by opium and a draught of castor oil, and the constipation by small repeated doses of sulphate of magnesia and sulphuric acid.

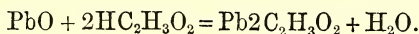
In case of acute poisoning by sugar of lead (acetate) or other soluble salt of lead, the best antidote is a soluble sulphate or phosphate, e. g. sulphate of sodium or of magnesium (Epsom salt), alum, or phosphate of sodium, any of which will form with the lead an insoluble and inert compound. The metal is capable of being detected in most of the organs of the body long after the ingestion of the poison.

\* The term *Saturn* was applied by the alchemists to lead.

## PLUMBI ACETAS.



*Preparation.*—Dissolve oxide of lead (litharge) in slight excess of acetic acid by the aid of a gentle heat—



*Characters and Tests.*—Commonly known as *sugar of lead*, from its sweet taste, afterwards astringent. It is readily soluble in water, and its solution in common water is turbid, owing to the formation of carbonate of lead by the alkaline carbonates, which such water always contains. A few drops of vinegar or dilute acetic acid will clear the solution from the precipitated carbonate of lead.

The purity of the salt is estimated by ascertaining how much of the standard solution of oxalic acid is required to precipitate a known weight of it. 38 grs. ( $\frac{1}{10}$  of the molecule) = 200 grain-measures of the oxalic acid solution, which contain  $\frac{1}{10}$  of a molecule of the acid.

The other tests have already been explained under Plumbum.

*In Pharmacy.*—Sugar of lead is used directly in the preparation of the subacetate of lead, and also of strychnia; it forms  $\frac{3}{4}$  of the Pil. Plumbi c. Opio, and occurs in a Suppository, and an Ointment. Lead forms so many insoluble compounds that the acetate in solution is incompatible with most acids, alkalies, and their carbonates and iodides, sulphates (alum), &c.

*In Medicine.*—The special uses of acetate of lead internally are—(a.) In restraining hemorrhage from the lungs, stomach, intestines, and uterus. Dr. Paris thought so highly of it in this capacity, that he applied to it the epithet, “*nil simile, nec secundum.*”

(b.) In checking morbid fluxes, e. g. in obstinate diarrhœa; it is frequently employed in the diarrhœa of phthisis, and of

typhoid fever, as well as in the exhausting perspirations of hectic fever.

(c.) In internal aneurisms, which cannot be reached by surgical means, it has been strongly recommended, and it seems to have some effect in promoting the coagulation of the blood in the tumour.

The average dose is 2 grs., given in pill, and the Pil. Plumbi c. Opio is a suitable formula in many cases.

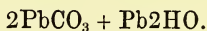
Externally, it is often used as a collyrium (1 or 2 grs. to ℥i.), lotion (℥ij. or ℥iij. to Oi.), injection, or incorporated with bread crumb into a poultice. Its solution should always be effected in *distilled* water.

On an ulcerated cornea the collyrium is liable to produce an indelible white stain (Jacob).

Acetate of lead is a frequent ingredient in hair washes and dyes, and slow poisoning has resulted from the use of such preparations.

The Liquor Plumbi Subacetatis has already been described. See p. 423.

## PLUMBI CARBONAS.



*Preparation.*—No process is given in the Pharmacopœia; but on the large scale, it is made by exposing thin sheets or gratings of lead, placed in earthen pots, to the combined action of acetic acid, air, and carbonic acid gas. The latter is generated either from layers of decaying organic matter, e. g. tan, manure, or refuse straw, packed between the earthen pots, or sometimes by the combustion of coke or charcoal. An oxy-acetate of lead first forms, and is continuously decomposed by the carbonic acid until most of the lead is converted into a flaky, white mass, which when ground, constitutes the officinal compound.

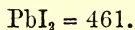
*Characters and Tests.*—Commonly called white lead (ceruse), and when mixed with linseed oil, it constitutes *white paint*.

Like all carbonates, except those of the alkalies, it is insoluble in water, but is readily soluble with effervescence in dilute nitric acid, or in acetic acid, and the solution will then answer to all the tests for lead. Its composition is somewhat variable, and the formula given above is not always rigidly true. It is often adulterated with insoluble sulphates (Ba, Ca, and Pb), detected by a residue being left after treatment with acetic acid; and with chalk or whiting, detected by oxalate of ammonium giving a precipitate in the acetic solution after removal of the lead by sulphuretted hydrogen.

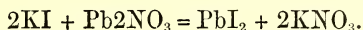
*In Pharmacy.*—Used as a mechanical purifier in the preparation of Liq. Gutta Percha.

*In Medicine.*—Only used externally as an application to ulcers, scalds, burns, and other inflamed and excoriated surfaces. It may be employed in the form of ointment, or as a paint made into a cream by linseed oil, or mixed with starch and dusted on the skin in eczema. The carbonate has been asserted to be the most poisonous preparation of lead, but without sufficient foundation.

## PLUMBI IODIDUM.



*Preparation.*—Add iodide of potassium to nitrate of lead—



Equal weights of the two reacting salts represent, in this case, the proper molecular proportions.

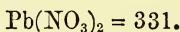
The solutions should be allowed to cool before being mixed, or the precipitate will sometimes be too distinctly crystalline. If prepared from acetate of lead instead of the nitrate, some loss might follow, as the resulting iodide is slightly soluble in acetate of potassium.

*Characters.*—Occurs as a bright yellow powder, darkened by heat, almost insoluble in cold water, but deposited from boiling water in golden crystalline scales. It is freely soluble in solution of acetate of sodium (Tommasi).

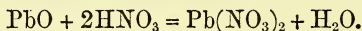
*In Medicine.*—Used externally, as Plaster or Ointment, to scrofulous ulcers and indolent swellings.

Iodide of cadmium has been introduced as a colourless substitute for it.

### PLUMBI NITRAS.



*Preparation.*—Dissolve litharge in nitric acid—



Instead of litharge, metallic lead or its carbonate may be employed.

*Characters and Tests.*—The crystals have a white, waxy appearance. Like all neutral nitrates, they are soluble in water, and the solution answers to the usual tests for lead.

It is known to be a nitrate by bleaching a solution of indigo in sulphuric acid when added to it.

*In Pharmacy.*—Employed only in the preparation of the iodide of lead.

*In Medicine.*—Although the nitrate possesses properties similar to those of the other lead salts, it is not in general use. It is occasionally employed as a local remedy to sore nipples, cracked hands, and has been especially recommended in cases of that obstinate affection, onychia maligna.

It formed the basis of “Ledoyen’s disinfecting (deodorising) fluid.”



## PLUMBI OXIDUM.

$\text{PbO} = 223.$

*Preparation.*—Litharge\* is obtained by roasting lead in a current of air, when the metal combines with oxygen, and the fused oxide separates on cooling, in small, brilliant, vitrified scales.

*Characters and Tests.*—The colour of litharge varies from red to yellow, and mixed with the protoxide there is generally some red oxide of lead ( $\text{Pb}_3\text{O}_4$ ). It slowly attracts  $\text{CO}_2$  from the air, and hence may give rise to effervescence when dissolved in diluted acids. Brick dust, if added fraudulently, would be left undissolved. Litharge usually contains copper, which is at once detected by the blue colour produced on the addition of excess of ammonia to the nitric acid solution. Oxide of lead is soluble in excess of potash.

*In Pharmacy.*—The acetate, subacetate, and nitrate of lead, are prepared directly from this oxide. When heated with a fat, e. g. olive oil, and water, it saponifies the fat, and oleate of lead is obtained, which constitutes the Emplastrum Plumbi, an ingredient in 10 of the other Emplastra. Oxide of lead is also used in estimating Acid. Phosph. Dil., and in the preparation of Digitalinum.

Litharge possesses the property of decolorising many vegetable fluids.

*In Medicine.*—It is never used internally.

\* $\text{Λιθος}$ , a stone; and  $\text{ἀργυρος}$ , silver; from the lead being thrown off in glistening scales during its application for the refinement of silver. (Paris.)

## PODOPHYLLI RADIX.

*Origin.*—The *may-apple* or *mandrake*, *Podophyllum*\* *peltatum*, N. O. Ranunculaceæ, is a herbaceous plant, widely diffused through the United States.

The stem bears but one flower, and two leaves, which are large, peltate and palmate, with six or seven blunt, wedge-shaped lobes. The flower is pendent, fragrant, of a delicate white, and ultimately gives rise to a large oval, fleshy berry, sometimes called *wild lemon* from its colour and form.

It is worthy of remark that the different parts of this plant are endowed with very different properties; thus the fruit is subacid, and may be eaten with impunity; the leaves are said to be poisonous, and the rhizome is powerfully cathartic.

*Characters.*—The rhizome, or underground stem (improperly called root), is known from other similar drugs by its size, about that of a quill, and by its brown, wrinkled, somewhat knotted exterior. The appearance of the powder resembles that of jalap. The only important constituents are—(1) a resin; and (2) a yellow alkaloid, berberin (*berberia*), which is not to be confounded with *beberia*. The amount of resin afforded is from 3 to 5%.

A specimen of *podophyllum*, grown in the Botanic Gardens, T. C. D., yielded, on analysis, 4.54% of resinous precipitate. (*Pharm. Journ.*, February, 1869.)

## PODOPHYLLI RESINA.

*Preparation.*—(1) Exhaust *podophyllum* with rectified spirit; (2) concentrate the tincture so obtained, and add it to water acidulated with a little hydrochloric acid. Collect and dry the precipitate, which will actually consist of resin of *podophyllum*, and hydrochlorate of berberin.

\* Πούς, a foot; φύλλον, a leaf.

*Characters.*—The pure resin is white, but as usually seen, it is of a pale olive brown colour, owing to the presence of some berberin. The resin is inappropriately styled *podophyllin*, for it is not a definite active principle, but a mixture of at least two resinous substances, one soluble in ether, and the other not. Like jalap resin it is insoluble in oil of turpentine, and it is strikingly distinguished by its property of being precipitated by acids from its alkaline solutions.

*In Medicine.*—Podophyllum is a very active and certain cathartic, producing copious thin discharges. It is intermediate in its action between gamboge and jalap, less griping than the former, and more powerful than the latter. As a brisk cholagogue purgative (vegetable calomel) it is well adapted to cases of obstinate constipation, and congestive affections of the abdominal viscera; and on account of its hydragogue qualities, it is suited to many cases of dropsy.

Podophyllum is locally irritant, and its dust is well known in the drug trade to produce “inflamed eyes,” and an eruption of “scabs” on the arms and legs of the men who attend the mill in which the drug is ground.

The average dose of the resin, if of good quality, is  $\frac{1}{2}$  gr., but it is better to add a smaller quantity, i. e.  $\frac{1}{6}$  gr. to another cathartic, e. g. Pil. Coloc. Co., whereby an effective and sure combination is obtained, without risk of exciting nausea or undue purging. A little extract of belladonna may at the same time be added with advantage, as a sedative. Combination with common salt is said to increase its purgative action to an undesirable extent; lactic acid is stated to counteract its operation.

*POTASSIUM.**TABLE OF THE COMPOUNDS AND PREPARATIONS OF  
POTASSIUM IN THE PHARMACOPŒIA.*

## CLASS I. OXIDE.

- |                      |                    |
|----------------------|--------------------|
| 1. Potassa Caustica. | KHO.               |
| Liq. Potassæ.        | 27 grs. KHO in 3i. |

## CLASS II. NON-OXYGENATED (HALOID) SALTS.

- |                            |  |
|----------------------------|--|
| 2. Potassa Sulphurata.     | K <sub>2</sub> S <sub>3</sub> , mainly.  |
| Ung. Pot. Sulphur.         | 30 grs. to 3i.   |
| 3. Potassæ Prussias Flava. | K <sub>4</sub> FeC <sub>6</sub> N <sub>6</sub> , 3H <sub>2</sub> O = K <sub>4</sub> FeCy <sub>6</sub> .                    |
| Solution of,               | App. II.   |
| 4. Potassæ Prussias Rubra. | K <sub>6</sub> Fe <sub>2</sub> C <sub>12</sub> N <sub>12</sub> = K <sub>6</sub> Fe <sub>2</sub> Cy <sub>12</sub> , App. I. |
| Solution of,               | App. II.   |
| 5. Potassii Bromidum.      | KBr.   |
| 6. Potassii Iodidum.       | KI.  |
| Linim. Iodi.               |  |
| „ Pot. Iod. c. Sap.        |  |
| Liquor Iodi.               |  |
| Tinctura Iodi.             |  |
| Ung. Iodi.                 |  |
| „ Pot. Iodidi.             | 1 part in 8¾.  |

## CLASS III. OXY-SALTS.

- |                          |  |
|--------------------------|--|
| 7. Potassæ Acetas.       | KC <sub>2</sub> H <sub>3</sub> O <sub>2</sub> = KĀ.                              |
| Solution of,             | App. II.   |
| 8. Potassæ Bicarbas.     | KHCO <sub>3</sub> .  |
| Liq. Pot. Efferv.        | 30 grs., KHCO <sub>3</sub> to Oi.  |
| 9. Potassæ Bichromas.    | K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> .                                  |
| Volumetric solution of,  | App. III.  |
| 10. Potassæ Carbonas.    | K <sub>2</sub> CO <sub>3</sub> .   |
| 11. Potassæ Chloras.     | KClO <sub>3</sub> .  |
| Trochisci Pot. Chlor.    | 5 grs. in each.  |
| 12. Potassæ Citras.      | K <sub>3</sub> C <sub>6</sub> H <sub>5</sub> O <sub>7</sub> = K <sub>3</sub> Ci. |
| 13. Potassæ Nitras.      | KNO <sub>3</sub> .   |
| 14. Potassæ Permanganas. | KMnO <sub>4</sub> .  |
| Liq. Pot. Permang.       | 4 grs. to 3i.  |

15. Potassæ Sulphas.	$K_2SO_4$ .
16. Potassæ Tartras.	$K_2C_4H_4O_6 = K_2\overline{T}$ .
17. Potassæ Tartras Acida.	$KHC_4H_4O_6 = KHT$ .
Conf. Sulphuris.	1 of KHT in 9.
Pulv. Jalapæ Co.	3 of KHT in 5.

All of these salts are colourless, except Potassa Sulphurata (liver coloured); Pot. Prussias Flava, or ferrocyanide (yellow); Pot. Prussias Rubra, or ferridecyanide (garnet red); Potassæ Bichromas (orange red); and Pot. Permanganas (deep purple).

*Origin.*—Potassium is a soft, silver white metal, easily cut with a knife, and with such an affinity for oxygen that it must be kept immersed in a liquid destitute of oxygen, such as Persian naphtha or benzine. Its sp. gr. is 0.865, and when thrown upon water it floats, and sets free hydrogen gas, which takes fire, the flame being tinged violet purple. Potassium was first isolated by Davy in 1807. The principal sources of potassium compounds are (1) in the mineral kingdom; the nitrate (saltpetre) found in soils, and as an incrustation upon the earth, especially in warm countries; and the chloride, found at Staasfurt, in Prussia, in the form of a mineral *Carnallite*, combined with NaCl and  $MgCl_2$ . (2) From the vegetable kingdom we have cream of tartar (Pot. Tartr. Acida), derived from grape juice, and carbonate of potassium (crude potashes\*—pearlash), obtained by burning wood to ashes. From the latter, most of the other compounds of potassium are prepared, directly or indirectly.

*Chemical relations.*—Potassium is a monad, K,† and it belongs to the class of alkaline metals (Na, L,  $NH_4$ ), i. e. those whose oxides

\* Called *pot-ashes*, because evaporated to dryness in iron pots—hence the name potassium for the metal.

† The symbol K is the initial letter of *kalium*, a term derived from *kali* Arabic for ashes; hence the word, *alkali*.

(alkalies) are strong bases, and form soluble carbonates. The best general *test* for potassium in solution is  $\text{PtCl}_4$ , which produces with  $\text{KCl}$  (or any salt of potassium in presence of  $\text{HCl}$ ) a yellow precipitate of double chloride of potassium and platinum ( $\text{PtCl}_4, 2\text{KCl}$ ). This test will distinguish potassium from sodium, which affords no precipitate with  $\text{PtCl}_4$ , but will not distinguish potash salts from salts of ammonium, which behave in an analogous manner to potassic salts. Another test, often employed, is tartaric acid, which when added in excess, produces a white crystalline precipitate of cream of tartar ( $\text{KHT}$ ). Ammonia yields an analogous precipitate, but soda does not; therefore in searching for potash, salts of ammonium must first be eliminated, if present, by evaporating the solution to dryness and heating.

*General Therapeutical Effects.*—A short general summary will here be given of the leading therapeutical effects of potassium compounds, and the remarks will be applicable in the main to sodium. The salts of potassium are essential constituents of the body, they are nearly all soluble, and occur most abundantly in the juice of muscle, and in the milk. Generally, it may be said, that potash salts are more deleterious than soda salts, especially when introduced directly into the circulation, or used in a concentrated form, and they are capable of exercising a most injurious influence on the blood by destroying its red corpuscles and impairing nutrition.

Since the stronger alkalies exercise several distinct actions, it will be convenient to refer to them under a few separate heads.

*Externally*, the fixed alkalies have a great affinity for water, and rapidly dissolve albuminous bodies, hence they are employed as *caustics*, e. g. Pot. Caustica (Liq. Pot.), and Pot. Carbonas, for the destruction of warts, the formation of issues, &c.



*Internally.*—1. As *antacids*, e. g. in acid diarrhœa, and dyspepsia, they are at least palliative, and are often beneficially combined with vegetable tonics and aromatics, e. g. Calumba.

They are employed as antidotes in cases of poisoning by acids (sulphuric, oxalic), and to neutralise excess of lithic acid in the system (lithiasis; gout). For this purpose, potash or lithia must be prescribed and not soda, on account of the insolubility of lithate (urate) of sodium. But on the contrary, if the tendency be to deposition of phosphates in the urine, alkalies must above all things be avoided, as they would only increase the evil.

2. In *acute rheumatism*, alkalies are adopted by many practitioners, and their use is said to obviate the tendency to heart complications, although the value of alkalies, or indeed of any drug treatment in rheumatic fever, has of late been entirely denied by Sir W. Gull and Dr. Sutton.

Bicarbonate and nitrate of potassium are the salts most frequently used, also the citrate and acetate.

3. To relieve *irritability of the urinary and generative organs*, alkalies are often employed, combined with hyoscyamus or opium. As external sedatives to allay itching, alkaline baths, or lotions of carbonate and bicarbonate of potassium, are often of great use in some skin diseases, eczema, lichen, &c.

4. As *diuretics*, the claims of alkaline salts, e. g. acetate and nitrate of potash, and bicarbonate of soda, have been generally maintained, and in congestive affections of the kidneys they often appear to be of signal service. It should be remembered that alkaline salts of vegetable acids (citric, tartaric, acetic) pass out in the urine as carbonates.

5. As safe *purgatives*, with a mild hydragogue action, the alkaline tartrates, sulphates, and phosphates, are often prescribed.

6. As *specific effects*, may fairly be classed the utility of iodide of potassium in certain stages of syphilis, its extraordinary powers in promoting the healing of obstinate tertiary sores, the removal of syphilitic deposits, internal or external, and its efficacy in rheumatic periostitis.

Again, may be instanced the undoubted usefulness of bromide of potassium in nervous diseases, especially in epilepsy, in which it at least possesses the power of retarding and mitigating the convulsive seizures, and in some cases may even cure the disease.

The value of potassium salts as *antiscorbutics* seems to be over-estimated, and Dr. Garrod's theory, that scurvy is attributable to a deficiency of potassium salts in the system, cannot be maintained.

## POTASSA CAUSTICA.

KHO = 56.

The term *caustic potash* is commonly applied both to the solid hydrate,\* and to its solution in water, *Liquor Potassæ*, which has already been described, p. 424.

In commerce, the term *potash* is frequently applied to the carbonate of potassium.

*Preparation.*—Evaporate *Liq. Potassæ* to dryness in a clean silver or iron vessel as quickly as possible; fuse, and pour into proper moulds.

Neither platinum, glass, nor porcelain vessels are admissible, as the potash would act injuriously on any of those materials.

*Characters and Tests.*—It usually occurs in white, fibrous sticks, similar to those of  $\text{AgNO}_3$ , and  $\text{ZnCl}_2$ . It has such an affinity for water and carbonic acid, that it must be kept in

\* A "hydrate" is a compound of a metal (or other radical) with  $n\text{HO}$ , according to the atomicity of the metal, e. g.  $\text{KHO}$ ,  $\text{Ca''}2\text{HO}$ , &c.

closely stoppered bottles. It is readily soluble in alcohol as well as in water. During its solution in water, heat is evolved.

As impurities, derived from the *Liq. Potassæ*, caustic potash usually contains chlorides and sulphates, which are respectively detected by nitrate of silver, and chloride of barium, giving white precipitates in the acidulated solution. The absolute alkaline value of the caustic potash is estimated by ascertaining how much oxalic acid a known weight of the alkali requires for neutralisation. If perfectly pure, 56 grs.  $\text{KHO}$  (one molecule) would require 1000 gr. measures of the volumetric solution of oxalic acid.

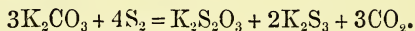
*In Pharmacy.*—Caustic potash is used in the preparation of various salts of potassium, e. g. permanganate, bromide, and iodide, and in the manufacture of soft soap.

*Liquor Potassæ* is frequently employed in chemical operations, to neutralise acids, to precipitate other insoluble oxides, &c.

*In Medicine.*—The solid hydrate of potassium is used only as a caustic, and it quickly and thoroughly destroys the life of the part to which it is applied, producing on the skin a soft grey slough, and penetrating to a considerable depth, unlike nitrate of silver. Placed in contact with living tissues, it dehydrates them, saponifies their fatty matters, and decomposes their nitrogenous substances. To form an issue, rub the moistened end of the stick on the skin, through a circular opening of suitable size in a piece of adhesive plaster. Any excess can be at once neutralised by a little vinegar. Potash mixed with  $\frac{1}{3}$  of its weight of quicklime, fused, and cast into rods, is a much more manageable form, is less deliquescent, and less liable to spread beyond the desired extent. Equal weights of potash and lime, powdered, and made up into a paste with a little alcohol as required is employed under the name of “Vienna paste.”

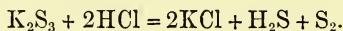
## POTASSA SULPHURATA.

*Preparation.*—Fuse together carbonate of potassium and sublimed sulphur—



Hyposulphite and sulphide of potassium are formed, but too high a heat will decompose the hyposulphite into sulphate, sulphite, and sulphide.

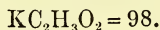
*Characters and Tests.*—From its hepatic colour when fresh it was formerly called “liver of sulphur,” but it rapidly absorbs oxygen from the air, and soon becomes green, and ultimately dull white,  $K_2SO_4$  being formed. Any acid will cause it to evolve sulphuretted hydrogen, e. g. if HCl be added—



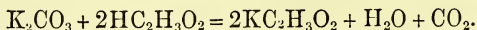
When recently made, about three-fourths of its weight (i. e. the sulphides present) are dissolved by rectified spirit. Sulphate of potassium is insoluble in spirit.

*In Medicine.*—Occasionally used externally (Ung. Pot. Sulphur.) in scabies, ringworm, &c., and as a bath in lead poisoning, and also in some skin affections.

## POTASSÆ ACETAS.



*Preparation.*—Neutralise acetic acid with carbonate of potassium—



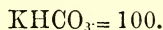
*Characters and Tests.*—A soft, fibrous, glistening, solid, unctuous to the touch, and with such an affinity for water, that on exposure to the air, it soon becomes liquid, and hence should be preserved in closely stoppered bottles. Soluble in about one-half its weight of water, and twice its weight of alcohol.

It is known to be an acetate, (1) by the disengagement of the volatile and odorous acetic acid on the addition of sulphuric acid, and (2) by striking a blood red colour with ferric salts (per-acetate of iron). It occasionally contains cream of tartar (from substitution of tartaric for citric acid in its preparation), which would render its solution acid to blue litmus paper; and lead, detected by sulphide of ammonium giving a black precipitate.

*In Pharmacy.*—A watery Solution of Acetate of Potash, 10% (App. II.), is used as a test for tartaric acid; and the salt is employed in the preparation of Tinct. Ferri Acet.

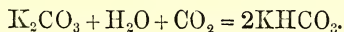
*In Medicine.*—It possesses the general properties of the potassium salts, but is mild in its action, and has long enjoyed the reputation of being an eliminating diuretic, and hence is frequently prescribed in dropsies, and in some skin diseases attended with deficient renal excretion, e.g. psoriasis, and eczema. Dr. Golding Bird and others have used it largely in acute rheumatism. It passes out through the kidneys as carbonate.

## POTASSÆ BICARBONAS.



*Preparation.*—Pass carbonic acid gas (generated from marble and hydrochloric acid) through a strong solution of carbonate of potassium for a week.

Crystals of the less soluble bicarbonate of potassium are gradually deposited—



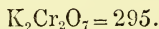
*Characters and Tests.*—Distinguished from the carbonate of potassium by its non-deliquescence, and by the absence of causticity. It is soluble in four times its weight of cold water, in less than its weight of boiling water, and is insoluble in

alcohol. Exposed to a low red heat it loses 31% of its weight, and is converted into neutral carbonate. Pure bicarbonate of potassium does not precipitate sulphate of magnesium, nor dilute solution of corrosive sublimate.

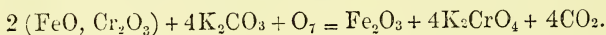
*In Pharmacy.*—Used to prepare Potash water (Liq. Pot. Efferv.) which is a weak solution of  $\text{KHCO}_3$  (gr. 30 to Oi), charged with an excess of carbonic acid gas under pressure. This salt is also used to confer effervescence upon the Liq. Magn. Citratis.

*In Medicine.*—One of the most frequently employed of the alkalies, and for internal use preferable to the carbonate of potassium, which is acrid and irritant. It is constantly prescribed in acute rheumatism, either in simple solution or in effervescence with citric or tartaric acid. A given quantity of the bicarbonate requires three-fourths of its weight of either citric or tartaric acid for neutralisation.

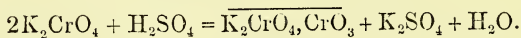
## POTASSÆ BICHROMAS.



*Preparation.*—Roast chrome iron ore ( $\text{FeO}$ ,  $\text{Cr}_2\text{O}_3$ ) with a mixture of carbonate of potassium and chalk (sometimes with the addition of a little nitre) in a furnace through which a current of air passes. Yellow chromate of potassium ( $\text{K}_2\text{CrO}_4$ ) is formed—



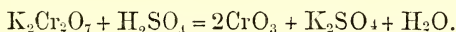
The chalk is added to keep the mixture in a porous state by diminishing its fusibility. The yellow chromate, when treated with sulphuric acid, yields the red bichromate—



*Characters and Tests.*—A fine orange red salt, known to be a chromate by the characteristic precipitates mentioned in the Pharmacopœia. It readily gives up part (3 atoms) of its oxygen,



and its solution acidified with  $\text{H}_2\text{SO}_4$ , and heated with a little alcohol or sugar, for example, speedily turns emerald green, owing to reduction of the chromic acid and formation of the green sulphate of chromium. Chromic anhydride, much used now in microscopic manipulation, also as a caustic, and in charging some forms of electrical battery, is deposited in crimson needles on adding excess of oil of vitriol to a cold saturated solution of bichromate of potassium—

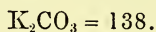


Dissolved in water, true chromic acid ( $\text{H}_2\text{CrO}_4$ ) is formed; a most powerful oxidising and corrosive agent.

*In Pharmacy.*—Used as an oxidiser, (1) in the conversion of fousel oil (amylic alcohol) into valerianic acid (see *Sodæ Valerianas*); (2) in Otto's test for strychnia (see *Strychnia*); (3) in the volumetric estimation (Penny) of protosalts of iron, by conversion into ferric salts; (4) to distinguish cinnamic from benzoic acid. The former acid, when oxidised, gives off the odour of essential oil of almond (hydride of benzoyl), the latter does not (see *Styrax*). An acidified solution of bichromate is used as a test for alcohol. A dilute solution of chromic acid (1 in 1000 of water) is a most delicate test for guaiacum resin, with which it strikes a beautiful blue (Schiff).

*In Medicine.*—Seldom used now, although it has been employed externally as a caustic, and internally, as an emetic, and in the treatment of syphilis. Workmen engaged in its manufacture are liable to painful ulcerations of the hands and other parts, and to perforation of the cartilaginous septum of the nose.

## POTASSÆ CARBONAS.



*Preparation.*—When the wood of any plant is burned with free exposure to air, an ash is obtained which varies much in amount, from 0.05% to nearly 10% of the part burned. This ash consists of a soluble ( $\text{K}_2\text{CO}_3$  derived from decomposition of organic salts, and other alkaline salts) and an insoluble portion (silica, lime salts, &c.), and when washed or lixiviated with water, the former substances are dissolved out. This solution, evaporated and fused, yields the crude potashes of commerce—a hard, stony mass of a light brown colour. If crude or black *potashes* be now calcined in a reverberatory furnace, the combustible impurities are burnt out, and a dull white residue, termed *pearl ash*, is obtained. But even this is too impure for medical use, and must be freed from impurities (sulphate and chloride of potassium) by treating it with a *small quantity* of water, filtering and evaporating the solution to dryness.

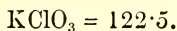
*Characters and Tests.*—Distinguished from bicarbonate of potassium, or from the carbonates of sodium, by its extreme affinity for water—so that, on exposure, it soon melts into a thick liquid (deliquesces), and hence must be kept in closely stoppered bottles. As it is never perfectly pure, it is not completely soluble in water, but leaves behind a trace of lime salts, and the solution in nitric acid shows traces of sulphates and chlorides when tested by chloride of barium and nitrate of silver respectively. Its alkaline strength is estimated, as usual, by the standard solution of oxalic acid. 81% of pure  $\text{K}_2\text{CO}_3$  should be present.

*In Pharmacy.*—Used in the preparation of several other potassium salts, e. g. Pot. Acet., and Pot. Citras; to dissolve arsenious oxide in Fowler's Solution (Liq. Arsenic.); to render aloes more soluble,

e. g. Enema Aloes, Dec. Aloes Co.; to precipitate carbonate of iron in Griffith's mixture (Mist. Ferri Co.); and in the extraction of Atropia from belladonna.

*In Medicine.*—Not much used internally, on account of its causticity and acridity, but occasionally prescribed as an antacid and diuretic. A given quantity of the carbonate requires nearly its own weight of citric or tartaric acid for neutralisation. Locally, it is used in the treatment of some cutaneous affections in the form of bath; lotion (3 i. – 5 ij. to Oi.); or ointment (10 grs. to ʒi.).

### POTASSÆ CHLORAS.



*Preparation.*—Pass chlorine gas (generated from  $\text{MnO}_2$  and  $\text{HCl}$ , see Liq. Chlori) over a mixture of potassic carbonate and excess of slaked lime. Chlorinated lime (bleaching salt) and chlorinated potash are first formed, and then decomposed into chlorate of potassium on boiling, but the reaction may be simply expressed as— $6\text{Cl}_2 + \text{K}_2\text{CO}_3 + 6\text{CaH}_2\text{O}_2 = 2\text{KClO}_3 + \text{CaCO}_3 + 5\text{CaCl}_2 + 6\text{H}_2\text{O}$ .

Filter, and evaporate the solution until the sparingly soluble chlorate crystallises out.

*Characters and Tests.*—Distinguished by its appearance as pearly white, hard, crystalline plates, which are only slightly soluble (6 to 7%) in cold water. The presence of chlorides or of lime would be detected by nitrate of silver and oxalate of ammonium respectively, giving white precipitates in its solution. It explodes violently if triturated with sulphur, phosphorus, hypophosphites, &c., and crackles, like a nitrate, when thrown on a hot coal. When fused by heat, it first forms potassic perchlorate ( $\text{KClO}_4$ ), and finally gives off all its oxygen ( $\text{KClO}_3 = \text{O}_3 + \text{KCl}$ ), and yields a residue of potassic chloride. A solution of the residue will now afford a precipitate with  $\text{AgNO}_3$ , and thus be distinguished from the original chlorate. Hydrochloric acid

liberates from the chlorate a yellow gas (euchlorine)—a mixture of chlorine with one of its oxides.

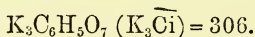
*In Pharmacy.*—It is an energetic oxidiser, and is used for this purpose in the preparation of Potassæ Permanganas. Dangerous accidents by explosion have occurred from dispensers incautiously triturating this salt with tannic acid, catechu, or hypophosphite of sodium.

*In Medicine.*—Although the recommendation of this salt (Berthollet's salt) on theoretical grounds, as an oxidiser, has been reiterated without foundation, since it appears to pass rapidly unchanged through the system, it is capable of some useful applications. Thus, in common and in ulcerative sore throat, and stomatitis, in scarlatina, and in the loaded state of the digestive organs at the commencement of fever, it is most valuable in promoting the healing of the mucous membrane, in diminishing the lingual fur, and the foul breath and taste.

In mercurial stomatitis and in cancrum oris it is usually prescribed, and in these cases its local and internal use may be advantageously combined.

The salt may be given freely in doses of 20 or 30 grs. frequently through the day, and as a lotion, ʒi. – ʒiv. in Oi. of water may be used.

### POTASSÆ CITRAS.



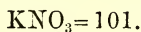
*Preparation.*—Neutralise citric acid with carbonate of potassium— $3\text{K}_2\text{CO}_3 + 2\text{H}_3\text{C}_6\text{H}_5\text{O}_7 = 2\text{K}_3\text{C}_6\text{H}_5\text{O}_7 + 3\text{H}_2\text{O} + \text{CO}_2$ .

*Characters and Tests.*—This salt is crystallisable, but usually occurs as a white granular powder, soluble in water, and insoluble in alcohol. It is charred by hot sulphuric acid, and its solution gives a precipitate (citrate of calcium) with chloride of calcium, only *when boiled*, a character which distinguishes it from the tartrate of potassium. Citrate of calcium is insoluble in *hot*

water, but soluble in cold water. When heated to redness, a residue of carbonate is left, as is the case with all organic acids, and since the acid is tribasic, 102 grs (i. e. one-third of the molecule of the salt) will contain one molecule of potash, and will therefore neutralise 1000 gr. measures of the standard oxalic acid solution.

*In Medicine.*—An agreeable refrigerant, usually prescribed in the form of effervescing mixture, viz. citric acid and potassic bicarbonate. (See Pot. Bicarb.)

### POTASSÆ NITRAS.



*Origin.*—Nitrates occur naturally in waters, soils, and the juices of many plants, and a crust of small crystals of nitre sometimes forms on medicinal extracts. But the main sources of potassic nitrate are, (1) as an incrustation on the soil in various parts of the world, and especially in India; it is directly extracted from the soil by water; (2) artificial “nitre-beds”—i. e. heaps of manure and other animal and vegetable refuse, wood ashes, and calcareous earth, which are exposed for a considerable time to the action of the air and sun, whereby the nitrogen of the organic matter is slowly oxidised into nitric acid. This combines with the bases (potash, &c.) present in the ashes and soil, and the nitrates so formed are removed by washing. The crude nitre, or saltpetre, is then purified, if necessary, by recrystallisation from water.

*Characters.*—The striated, long prismatic crystals distinguish ordinary nitre from Chili saltpetre—i. e. nitrate of sodium, which occurs in cuboidal crystals. Like all nitrates, it sparkles and crackles when thrown on a live coal. It is readily soluble in water, and is sparingly soluble in rectified spirit. When fused and cast into suitable moulds it forms little bullet shaped masses (or sometimes, circular cakes), termed *sal prunelle*.

The proof that it is a nitrate is given by its evolving ruddy fumes of  $\text{NO}_2$  when warmed with copper wire and a little sulphuric acid (to liberate nitric acid). Its most usual impurities, viz. alkaline chlorides and sulphates, are tested for by nitrate of silver and chloride of barium respectively.

*In Pharmacy.*—Employed as the source of nitric acid (see Ac. Nitr.) and in the manufacture of sulphuric acid (see Ac. Sulphuricum). In the laboratory it is frequently used as an oxidising agent.

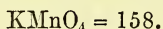
*In Medicine.*—In large doses it is irritant, and some fatal cases have occurred from overdoses (1 to 3 oz.).

As a medicinal agent, nitre is usually considered as a non-stimulating diuretic, and a vascular sedative. It is often employed in inflammatory diseases, and acute sore throat, and in rheumatic fever it is highly esteemed by some practitioners.

Fumigation of “touch-paper” (i. e. blotting paper impregnated with nitre) sometimes affords speedy relief to an attack of spasmodic asthma.

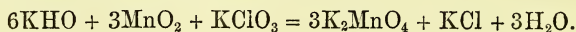
Nitre is eliminated unchanged in the urine.

## POTASSÆ PERMANGANAS.



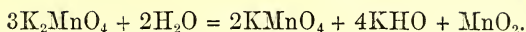
*Preparation.*—The principal steps of the process are (1) Prepare manganate of potassium ( $\text{K}_2\text{MnO}_4$ ); (2) Convert this into permanganate ( $\text{KMnO}_4$ ), by boiling.

Fuse together black oxide of manganese, caustic potash, and potassic chlorate (as an oxidiser):—



A dark green mass of manganate is obtained, and this when boiled, filtered, and acidified with sulphuric acid, yields a purple solution of permanganate—





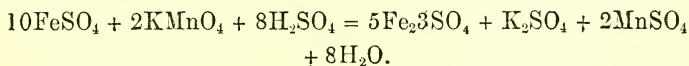
The green manganate in turning into the purple permanganate undergoes several changes of colour, and hence the term *mineral chameleon* applied to it.

Evaporate to crystallisation; redissolve the crystals in a little water, and strain through a funnel lightly stuffed with *asbestos* (a fibrous silicate), for paper or other organic filtering material (except gun cotton) would decompose the permanganate.

*Characters and Tests.*—The two most remarkable characters of this salt are, (*a*) the beautiful lilac purple colour, even of a very dilute solution; and (*b*) the facility with which it yields up  $\frac{5}{8}$  of its oxygen, especially when in contact with organic substances, solid or liquid, e. g. rectified spirit, and leaves a brown residue of hydrated  $\text{MnO}_2$ . This is the brown stain formed on the hands when washed in a moderately strong solution of it. Oxalic acid, or “salt of lemon,” will readily remove these manganese stains. A solution of permanganate of potash in distilled water will retain its colour for two years.

It is decomposed at a red heat, and leaves a residue of  $\text{MnO}_2$  and potash.

Even on inorganic substances it acts powerfully; thus it converts oxalic acid into carbonic acid gas ( $\text{C}_2\text{O}_3 + \text{O} = 2\text{CO}_2$ ), and it oxidises any ferrous salt in acid solution into its corresponding ferric salt. The officinal test for its purity is based on the amount of pure ferrous sulphate a given weight of the permanganate will convert into ferric salt, the purple colour of the permanganate being thereby destroyed—



*In Pharmacy.*—Liq. Potassæ Permang., which in common with most of the important Liquores contains 4 grs. to  $\mathfrak{z}\text{i}$ .,

must be kept in perfectly clean bottles, else it will rapidly decompose.

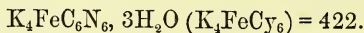
On account of its tendency to lose oxygen, it is incompatible with almost every organic substance, viz. tinctures, infusions, glycerin; also with ferrous (proto-) salts, sulphurous acid, essential oils, &c.

*In Medicine.*—Introduced into notice by Mr. Condry, in 1857, permanganate of potassium has since come into extensive use, and its extraordinary efficacy in destroying fetid odours is unquestionable. As a stimulant and cleansing deodoriser it is frequently and successfully used in the local treatment of foul and gangrenous sores and wounds of all kinds, and of offensive mucous discharges, and in gonorrhœa, &c., in the form of lotion, 2 to 4 grs. to ℥i. On account of its non-volatility its efficiency as a disinfectant cannot be very great.

Solutions of the manganate or permanganate of potassium are commonly sold in the shops under the names of “Condry’s fluid,” or “ozonised water.” In the solid state or in concentrated solution the permanganate is irritant and even caustic.

Internally, it has been recommended in diabetes, and in purulent infection, but the evidence in its favour is unsatisfactory. The dose is from gr. ss. to gr. i., and upwards.

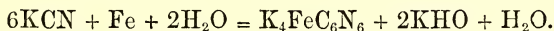
#### POTASSÆ PRUSSIÆ FLAVA.



Of the three cyanogen compounds in the Pharmacopœia, viz. hydrocyanic acid, red, and yellow prussiate of potash, none of which are found in nature, the last is pharmaceutically the most important, as being the one from which all cyanides are directly or indirectly obtained.

*Preparation.*—When animal refuse containing C and N) is heated with carbonate of potash and iron filings or waste iron,

the carbon and nitrogen unite to form cyanogen ( $\text{CN} = \text{Cy}'$ ), and ultimately, on boiling with water, a complex salt of cyanogen in union with potassium and iron is produced, the well known ferrocyanide of potassium or yellow prussiate of potash—

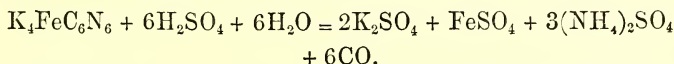


*Characters and Tests.*—The large, four-sided, transparent lemon yellow crystals of this salt, form a beautiful mass, which, though difficult to powder, is readily soluble in water. Its most characteristic tests are, (1) it yields a deep blue precipitate (Prussian blue) with persalts of iron; (2) it evolves prussic acid when heated with dilute sulphuric acid.

The iron in this salt cannot be detected by any of the ordinary tests, and is in combination with the Cy to form a compound radical, ferro-cyanogen.

*In Pharmacy.*—A solution in water, 1 in 20 (App. II.) is frequently used as a test (blue precipitate) for persalts of iron, while with pure protosalts of iron, a white precipitate is obtained (see Ferri Sulphas).

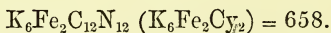
Prussic acid is now always prepared from the yellow prussiate of potash by heating it with diluted sulphuric acid (see Ac. Hydrocy.). With *strong* sulphuric acid it undergoes a different decomposition:—



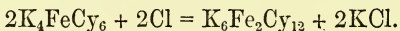
*In Medicine.*—Though recommended in various affections it has not found much favour, and is seldom or never prescribed. Curiously enough, although all simple cyanides and all true double cyanides, e. g. ( $\text{KC}_y, \text{AgC}_y$ ), are highly poisonous, the complex cyanides, such as ferro- and ferrid-cyanide of potassium, in which only the basic metal can be recognised, are non-poisonous, except in the case of compounds containing poisonous metals. When ingested, yellow prussiate of potash is absorbed

and passes off quickly in the urine, in which secretion it can be detected in about half a minute after having been swallowed.

### POTASSÆ PRUSSIÆ RUBRÆ.



*Preparation.*—Pass chlorine gas through a solution of yellow prussiate of potash, until the liquid ceases to give a precipitate with ferric chloride—



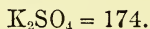
*Characters.*—Crystallises in beautiful garnet red crystals, soluble in water, forming a green solution.

While in the ferro-cyanides, the single atom of iron is in the ferrous state,  $\text{Fe}''$ ; in the ferrid-cyanides, the double atom is ferric and sexivalent,  $\text{Fe}_2^{\text{vi}}$ .

*In Pharmacy.*—A solution of the ferrid-cyanide or red prussiate of potash, 1 in 20 (App. II.), is used for the purpose of detecting protosalts of iron, with which it gives a deep blue precipitate (Turnbull's blue). It forms no precipitate with ferric salts.

*In Medicine.*—Although both the ferro- and ferrid-cyanide are soluble in water, neither is capable of exercising the characteristic influence of iron on the system. They are absorbed with remarkable facility into the blood. Before elimination, the red is changed into the yellow prussiate, which passes out unchanged in the urine, and can be readily detected in it by a ferric salt.

### POTASSÆ SULPHAS.



*Preparation.*—No process is given, but the salt may be prepared from the residue left in the manufacture of nitric acid, viz.

the acid sulphate of potassium, which is converted into the neutral salt by addition of potassic carbonate.

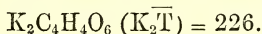
*Characters and Tests.*—A very hard crystalline salt, sparingly soluble in cold water, and possessing a bitter, nauseous taste.

*In Pharmacy.*—It is added to several pharmaceutical preparations, on account of its hardness, to aid in the trituration or division of vegetable drugs, e. g. Pil. Coloc. Co., and Pulv. Ipecac. Co. (Dover's powder). Used as a test for cerium in Cerii Oxalas.

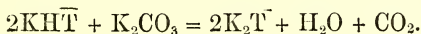
*In Medicine.*—A mild saline purgative, often combined with rhubarb. When given after delivery it is reputed to have the power of drying up the secretion of milk.

Death has resulted from very large doses, i. e. from 1 to 2 ounces.

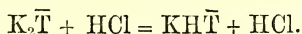
#### POTASSÆ TARTRAS.



*Preparation.*—Like all the tartrates, it is prepared from cream of tartar. The acid salt is converted into the neutral salt by the addition of potassic carbonate—



*Characters and Tests.*—A bitter salt occurring in small, almost granular crystals; soluble in water and sometimes termed *soluble tartar*. It is charred immediately by hot sulphuric acid, and is decomposed into carbonate of potassium at a red heat. Any soluble acid added to it, e. g. acetic or hydrochloric, causes a precipitate of the acid tartrate of potassium—



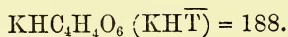
Since it is a neutral dibasic salt, 113 grs. (i. e.  $\frac{1}{2}$  a molecule =  $2\frac{3}{2}^6$ ) will, when converted into carbonate by heat, exactly

neutralise 1000 gr. measures of the volumetric solution of oxalic acid, which correspond to 1 molecule of alkali.

*In Pharmacy.*—For the reason explained above this salt should not be prescribed in combination with a free acid, e. g. Infusum Rosæ Acidum.

*In Medicine.*—A safe and mild hydragogue purgative which may be usefully combined with senna.

## POTASSÆ TARTRAS ACIDA.



*Preparation.* Grape juice contains naturally a considerable quantity of acid tartrate of potassium held in solution by the saccharine matter of the grape. During the fermentation of wines, i. e. the conversion of the sugar into alcohol, the acid tartrate (mixed with tartrate of calcium and colouring matter) is gradually deposited, on account of its insolubility in the alcohol produced. The crystalline crust formed inside the wine casks is termed *crude tartar* or *argol*, and this, when purified by recrystallisation, constitutes cream of tartar, a term originally applied to the fine crystals which were skimmed off the liquid as it evaporated.

*Characters and Tests.*—A hard gritty salt, easily distinguished from the neutral tartrate of potassium by its very sparing solubility in water, viz. about 1 in 180. When heated, a residue of potassic carbonate and charcoal is left (black flux). Since this tartrate contains only 1 atom of potassium, the calcined residue of carbonate from 188 grs. (i. e. 1 molecule) will exactly neutralise 1000 gr. measures of the volumetric solution of oxalic acid.

Commercial cream of tartar is seldom or never quite free from calcic tartrate, which can be detected in the calcined residue by the usual tests for calcium. The preparation sold under the



name of “essential salt of lemons,” for the purpose of removing iron moulds from linen, consists of cream of tartar and acid oxalate of potassium in equal proportions. (Paris.)

*In Pharmacy.*—All the other tartrates are derived from this tartrate by replacing its atom of acid hydrogen by another radical. It forms  $\frac{1}{9}$  of Conf. Sulph. and more than half of the Pulv. Jalapæ Co.

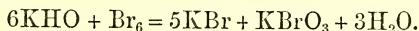
*In Medicine.*—A hydragogue cathartic and usually held to be a diuretic, hence it is frequently used in dropsical affections. It renders the urine alkaline, passing out as carbonate. The Pulv. Jalapæ Co. is a favourite combination, but a simple and more agreeable way of administering the salt is as *imperial*, a beverage made by adding sugar and lemon peel to a solution of  $\text{ʒss.}$  of the acid tartrate in Oijj. of boiling water. Cream of tartar may be given with safety in doses of  $\text{ʒss.}$  to  $\text{ʒi.}$  as a cathartic.

## POTASSII BROMIDUM.

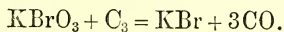
KBr = 119.

*Preparation.*—The process comprises two steps. (1) A mixture of bromide and bromate of potassium is formed; (2) the bromate is completely reduced to bromide.

Add bromine to Liq. Potassæ, until there is a slight excess, as indicated by the pale brown colour assumed by the liquid—



Then heat with charcoal, which does not affect the bromide, but facilitates the deoxidation of the bromate—



Dissolve out the bromide by water and crystallise. The action of bromine upon caustic potash is exactly parallel to that of chlorine and iodine.

*Characters and Tests.*—Occurs in cubical crystals, like those of iodide of potassium, but usually smaller, and sometimes ex-

hibiting a tinge of yellow from a little freed bromine. The proof that it is a bromide is given by adding chlorine (to liberate the bromine), and then chloroform or ether, which takes up the Br and is coloured red by it. The presence of potassic iodide would be detected by the blue colour afforded with starch after the addition of a little bromine or chlorine to set free the iodine. The quantitative estimation of the purity of this salt is effected by precipitation with standard solution of nitrate of silver. Bromide of potassium appears to be much more extensively and largely adulterated than iodide of potassium.

*In Medicine.*—Within the last forty years bromide of potassium has risen from insignificance to be one of the most esteemed medicines, and it is now extensively used.

Its principal physiological action is that of a direct sedative to the nervous system, lessening especially the reflex activity of the grey nerve centres, reducing the circulation, and in large doses producing tactile anæsthesia, not only of the skin, but especially of the mucous membrane of the fauces, conjunctiva and urethra. Hence it has been used in preparing an irritable throat for laryngoscopic examination. It also undoubtedly possesses anaphrodisiac powers, and is strongly to be recommended in priapism, chordee, and undue sexual excitement. It is easily absorbed from the mucous membranes, and is eliminated chiefly by the urine and saliva, but also by the sweat glands, and its prolonged use is sometimes followed by erythematous, vesicular, or acniform eruptions.

It was originally introduced into practice as a remedy for bronchocele and other glandular enlargements, and was especially recommended by Dr. R. Williams in 1831 for splenic and hepatic tumefactions; but it is probably not so efficacious in such conditions as the iodide of potassium, and certainly cannot be considered as a substitute for that drug in secondary and tertiary syphilis.

Its chief value lies in its application as a nerve sedative. Be-

sides its proposed uses in tetanus, whooping cough, spasmodic asthma, delirium tremens, the wakefulness of continued fever, and the insomnia of old age, it takes precedence of all other remedies in the treatment of epilepsy and epileptiform convulsions either in children or in adults. Although it cannot often be said to absolutely cure severe epilepsy, yet it undoubtedly can reduce the violence of the fits, retard their appearance, and lead to great improvement in the health of the sufferer.

For this purpose it may be pushed freely, e. g. ʒss. thrice a day, and some practitioners press this dose even higher.

Several unpleasant consequences (bromism) have been observed to follow its long continued use, and some individuals are very susceptible to its influence.

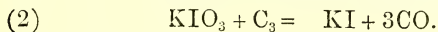
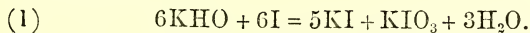
Excessive doses are apt to cause mental dulness, loss of memory, muscular weakness, and even temporary paralysis; and, in addition, general prostration, with enfeeblement or even loss of virile power, attended with headache, vertigo, gastric disturbance, dizziness, and somnolence.

All these phenomena point to a lowered excitability; there is no stage of excitation as in alcoholic, iodic, or opiate intoxication.

## POTASSII IODIDUM.

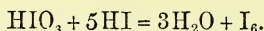
KI = 166.

*Preparation.*—The process is quite analogous to that for bromide of potassium—



*Characters and Tests.*—The crystals are usually cubical and opaque, with the faces regularly excavated, but they are sometimes octahedral and transparent. It is very soluble in water. That it is an iodide is shown by the blue colour developed with starch after the addition of nitric acid, or of minute quantities of solution of

chlorine or bromine. The iodide is liable to contain iodate from faulty preparation. This is detected either by its insolubility in rectified spirit, or better still by the blue colour developed on the addition of starch and a little acid, e. g. tartaric. The acid liberates iodic and hydriodic acids from the iodate and iodide respectively. Neither of these alone colour starch, but, by mutual reaction, free iodine is liberated, which at once forms the blue iodide of starch—



Chlorides, if present, would be precipitated by  $\text{AgNO}_3$  as chloride of silver along with the iodide of silver, but on the addition of ammonia, the chloride of silver alone would be dissolved, and could be reprecipitated by excess of nitric acid added to the clear fluid. Carbonates may be detected by the solution giving a precipitate with Liq. Calcis Sacchar. Notwithstanding its high price, iodide of potassium is found in commerce remarkably pure.

*In Pharmacy.*—Iodide of potassium exercises remarkable solvent powers over iodine, and moreover prevents its solution in spirit from being disturbed by dilution with water; hence its employment in Tinct. and Linim. Iodi. Insoluble iodides are prepared by its means, e. g. Hydrarg. Iod. Rubrum, and Plumbi Iodidum. In the former case more especially, any excess of KI must be avoided, as the precipitate is soluble in it, and indeed a solution of mercuric iodide in KI is frequently prescribed in medicine, and is used in testing alkaloids in medico-legal inquiry. Iodide of potassium acts on most mercurial preparations, and dissolves them to a greater or less extent.

*In Medicine.*—The general effects of iodide of potassium correspond to those of iodine which have already been described (see p. 391), and its tendency to irritate mucous membranes is shown by its sometimes producing symptoms like cold in the head, salivation, gastric irritation and purging. According to

Mr. Langston Parker, when long continued in large doses, it occasionally produces chronic glossitis, evidenced by a tender, swollen and fissured tongue. In some constitutions, various eruptions of the skin, and even bullæ and purpuric spots have been observed to follow its use, and occasionally, excessive œdema of the eyelids, with complete occlusion of the eyeballs, intense headache, ringing in the ears, and flashes of light in the eyes.

The salt passes unaltered into the secretions, is quickly eliminated, chiefly by the urine and saliva, and can readily be detected, in the urine, for example, by the addition of nitric acid and starch.

Among the more important special uses of the iodide are :—

In hydrocephalus, it sometimes seems to arrest, and perhaps cure this formidable disease. But its powers are most fully displayed in syphilis. In the later forms of syphilitic disease, as it attacks the bones, periosteum, skin, and viscera, its value is recognised on all sides, and it must often be given in large doses, viz. 30 to 80 grs. daily.

In saturnine and mercurial poisoning and palsy, it is in general use since the observations of M. Melsens, who has shown the power it possesses of aiding the elimination of lead and mercury from the system, by forming with these bodies soluble double iodides. During the progress of the treatment these metals can be detected in the urine. Moreover, if any mercury be lying dormant in the tissues, the result of a previous mercurial course, KI sometimes brings on salivation, and develops other active symptoms due to its combination with the latent mercury.

In chronic rheumatism, and in some cases of sciatica and lumbago, it is often of signal use; and on account of its efficacy in causing the removal of certain abnormal tissue deposits, it has been rather loosely recommended and widely employed in chronic inflammation of the liver, lungs, and serous membranes.

In the treatment of some nervous affections, e. g. certain cases of epilepsy, the iodide of potassium is recommended, and may

advantageously be combined with bromide of potassium. Its administration in full doses in the treatment of internal aneurism has been advocated, and it is certainly sometimes very useful in alleviating the sufferings of the patient, while it also appears to promote consolidation of the tumour.

Externally, potassic iodide, although sometimes employed as an ointment or liniment, is of doubtful efficacy.

The average dose for ordinary purposes is from 3 to 10 grs. given in water, but even so much as  $\text{ʒss.}$  has been given at a time without untoward consequences. The addition of a little carbonate of ammonia is recommended as an adjuvant.

## PRUNUM.

*Origin.*—The cultivated plum tree, *Prunus\** domestica, N. O. Rosaceæ, is familiar to everyone, and presents many varieties under cultivation. The best prunes are derived from the south of France, but the tree is said to have been originally a native of Asia Minor and Syria. The plum, a stone fruit or drupe, is prepared for commerce by drying in the sun, after having been exposed to the heat of an oven.

Dried plums contain a considerable amount of grape sugar (glucose).

*In Medicine.*—A mild laxative used only in the preparation of *Confectio Sennæ*, from which it might well be omitted.

## PTEROCARPI LIGNUM.

*Origin.*—Two species of *Pterocarpus*,† N. O. Leguminosæ, are officinal, viz. *P. marsupium*, which yields kino, and *P. santalinus*, which yields red sandal (saunders) wood, and is a native of India and Ceylon. Guibourt thinks it probable that red sandal wood comes from *Pterocarpus indicus*.

\* *Προύνη*, the plum tree.

† *Πτέρον*, a wing; *καρπός*, fruit.



*Characters.*—The wood has a faint violaceous smell, is tasteless, and is readily distinguished, even when in powder, from some other red woods, such as logwood, by the insolubility of its colouring matter in cold water. It imparts its colour to alcohol, ether, acetic acid, and alkaline solutions, and its red colour is due to *santalic acid* (*santalin*). The colour arises from the oxidation of an originally colourless principle, and Guibourt has seen a recent piece which was almost white internally gradually become completely red. The only volatile oils which dissolve the red colouring matter are those of lavender and rosemary (Pelletier).

An infusion of the wood in cold distilled water is of a pale sherry colour, and exhibits a dark blue fluorescence. The fluorescence is destroyed by boiling the infusion, which then becomes pale red.

*In Pharmacy.*—The wood has no medicinal virtues, and is used solely for the very unimportant purpose of imparting colour to Tinct. Lavand. Co.

### PULVERES.

Powders offer a convenient mode of administering some medicines, especially astringents and purgatives, and they are often adopted in the case of children. As a general rule, they should be preserved from the light, be kept in a dry place, and with many drugs it is a safer plan to powder only so much as is wanted for use at the time.

Some substances are obviously unfit for administration in powder, e. g. deliquescent bodies, such as carbonate of potash; or those containing much oil, which renders them liable to rancidity.

Bitter drugs are objectionable in the form of powder. The dose of a powder ought not to exceed ʒi; and when about to be taken, it should be diffused in water, wine, or other convenient liquid. Resinous and metallic powders require a thick and con-

sistent vehicle, such as syrup or honey, since they subside from those which are more fluid.

The more important of the officinal powders are, (1) the antimonial powder, (2) the four opiate powders, (3) the five purgative powders.

The proportions of the active ingredients in these powders are:—

ANTIMONIAL.			
Pulv. Antimonialis.	$Sb_2 O_3$	1	in 3
OPIATE.			
„ Opii Comp.	Opium	1	„ 10
„ Ipecacuanhæ Comp.	„	1	„ 10
„ Kino Comp	„	1	„ 20
„ Cretæ Aromat. c. Opio.	„	1	„ 40
PURGATIVE.			
„ Scammonii Comp.	{ Scammony	1	„ 2
	{ Jalap	1	„ 8
„ Jalapæ Comp.	Jalap	1	„ 3
„ Rhei Comp.	Rhubarb	1	„ 4
„ Glycyrrhizæ Comp.	Senna	1	„ 5
„ Elaterii.	Elaterium	1	„ 10

### PULVIS AMYGDALÆ COMPOSITUS.

A palatable combination of almonds, sugar, and gum, intended to afford a speedy method of preparing the almond mixture. It is liable to spoil by keeping.

### PULVIS ANTIMONIALIS.

A mechanical mixture of one part of oxide of antimony, and two parts of phosphate of lime, which promotes the fine subdivision of the antimonial oxide. About a century ago Dr. James, an English physician, introduced a nostrum which gained a good deal of favour, and for the preparation of which he bequeathed, after his death in 1776, a process, “worded with all

the ambiguity of an ancient oracle.” Since the genuine James’s powder, as sold by his representatives, is found to consist of a variable mixture of bone-phosphate and several antimonial compounds, a definite formula has been introduced as a recognised substitute for the secret preparation. It is doubtful whether the phosphate of lime adds anything to the efficacy of this preparation, and the oxide of antimony might be prescribed *per se*, were it not for the traditional value attached to the present combination.

*In Medicine.*—In small doses, i.e., 2 or 3 grs., it is diaphoretic and nauseating, and in larger doses, 5 to 10 grs., it is emetic and purgative. Some years ago it was much prescribed in febrile and acute diseases, and frequently conjoined with calomel and opium, but it is now held in less estimation. Solution of tartar emetic in appropriate doses is more generally employed in cases in which antimonials are indicated.

#### PULVIS CATECHU COMPOSITUS.

A useful combination, containing three vegetable astringents, which are very similar in their action.

#### PULVIS CINNAMOMI COMPOSITUS.

An aromatic stimulant combination which may be given in flatulent dyspepsia, and in diarrhœa. It is used as an adjuvant in the Pil. Aloes et Ferri, and Pil. Camb. Co.

#### PULVIS CRETÆ AROMATICUS.

A warm stimulant and antacid astringent. It contains more than half its weight of sugar, the proportion of which might with advantage be reduced.

## PULVIS CRETÆ AROMATICUS CUM OPIO.

This differs from the last only in the addition of opium, in the proportion of 1 in 40. It is well adapted as a sedative astringent for young children, because the opium is present in small quantity, and is uniformly diffused through the powder, so that the dose can be apportioned with accuracy.

## PULVIS ELATERII COMPOSITUS.

A safe and ready means of dispensing elaterium. It contains 1 gr. of elaterium in 10.

## PULVIS GLYCYRRHIZÆ COMPOSITUS.

Modified from a formula in the German Pharmacopœia.

A mild purgative combination, resembling in its effects the Confectio Sennæ.

## PULVIS IPECACUANHÆ COMPOSITUS.

This powder, although commonly called Dover's powder, does not precisely correspond with the preparation originally introduced by Dr. Dover, for his formula included liquorice, and nitre instead of potassic sulphate. The sulphate of potash serves by its hardness to promote the minute division and thorough intermixture of the opium and ipecacuanha, and by diluting the active ingredients the dose may be more suitably graduated.

It is an admirable anodyne diaphoretic, a property which crude opium does not usually manifest, and it is applicable to a number of cases.

The proportion of opium is 1 in 10. Instead of a full dose (10 grs.) of the bulky and nauseous powder, the following pill may advantageously be substituted:—℞ Extr. Opii, gr. i., Pulv. Ipecac. gr. i., Conf. Rosæ. q. s.

## PULVIS JALAPÆ COMPOSITUS.

A favourite and very useful hydragogue cathartic, frequently prescribed in dropsy, uræmia, &c. The acid tartrate of potash assists in the fine subdivision of the jalap. A full dose for an adult is 60 grs., = 20 grs. of jalap.

## PULVIS KINO COMPOSITUS.

A good anodyne and astringent combination, often prescribed to check diarrhœa or excessive sweating.

The proportion of opium is 1 in 10.

## PULVIS OPII COMPOSITUS.

An aromatic combination of opium, containing 1 gr. of opium in 10.

## PULVIS RHEI COMPOSITUS.

A useful laxative antacid, well known under the name of Gregory's powder.

The proportion of rhubarb is 1 in 4, nearly.

## PULVIS SCAMMONII COMPOSITUS.

An active hydragogue cathartic, in 20 gr. doses, = 10 grs. of scammony.

## PULVIS TRAGACANTHÆ COMPOSITUS.

Used in pharmacy as a vehicle for heavy insoluble powders.



## PYRETHRI RADIX.

*Origin.*—Is derived from *Anacyclus Pyrethum*, N. O. Compositæ, a plant closely allied to chamomile (*Anthemis*).

*Characters.*—It is easily distinguished from other roots by the peculiar tingling, and numb sensation, attended with free salivation, caused by chewing it.

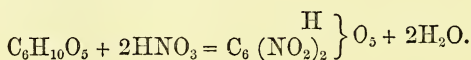
It contains a resinous matter called pyrethrin.

*In Medicine.*—A small piece of it chewed relieves inflammatory tooth-ache sometimes, and the tincture may be used as a gargle in relaxation of the uvula, and in similar conditions. A mouth wash of diluted Tinct. Pyrethri will lessen the viscid secretion of the mouth in small pox.

## PYROXYLIN.

*Preparation.*—By the action of nitric acid of different strengths on ordinary cotton, or cellulose,  $C_6H_{10}O_5$ , 1, 2, or 3 atoms of hydrogen can be replaced by 1, 2, or 3 molecules of peroxide of nitrogen ( $NO_2$ ). The greater the amount of  $NO_2$  introduced, the more explosive is the resulting pyroxylin (gun-cotton) and the less soluble in a mixture of alcohol and ether. In the official process, carded cotton (*Gossypium*) is steeped uniformly in a mixture of equal volumes of nitric and sulphuric acids for three minutes, then thoroughly washed from all free acid, and carefully drained and dried.

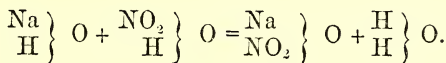
The reaction which occurs is :—



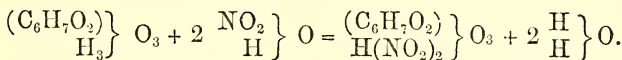
If the reaction be exhibited in the following manner, the decomposition will be seen to be strictly analogous to that which



occurs in the production of a nitrate by the action of nitric acid on a metallic hydrate, e. g. :—



And,



Gun-cotton therefore, is termed di-nitro-cellulose.

Mono-nitro-cellulose is less explosive, and is insoluble in ether. The hydrogen of cellulose is replaceable by other acid radicals, e. g. acetyl. Gun-cotton may be made with strong nitric acid alone, but it is better to mix it with sulphuric acid, which absorbs water and so strengthens the nitric acid.

Gun-cotton was discovered by Schönbein, of Basle.

It has been remarked that although as an explosive agent pyroxylin is a rival to gunpowder, yet, in the form of collodion, it becomes at the same time the indispensable auxiliary of the photographer, and the faithful aid of the surgeon—instead of causing wounds it heals them. (Hofmann.)

*Characters and Tests.*—Gun-cotton, although chemically so altered, has much the same appearance as ordinary cotton, but is heavier, harsher to the touch, and under the microscope, the fibres appear to have shrunk. It is sometimes at least, subject to spontaneous decomposition, gives off nitrous fumes, and crystals of oxalic acid are deposited on a gummy body. It inflames at from 300° to 370° F., when kindled flashes immediately, and if pure, leaves no residue. It is dissipated so rapidly that a small piece may be burnt on the finger nail with impunity, but if ignited in a confined space, e. g. in a fire-arm or a blast-hole, it exerts tremendous explosive power. If exploded on blue litmus paper it reddens it; if on starch paper, moistened with potassic iodide, the nitrous acid which is formed, liberates iodine and

produces a blue colour. Gun-cotton for medical purposes, should be readily soluble in a mixture of alcohol and ether, forming a powerfully adhesive liquid, viz. collodion. If of inferior quality, a thin non-adhesive liquid is obtained which leaves a brittle white film on evaporation. In any case, collodion deteriorates by long keeping.

*In Medicine.*—Used only in the form of Collodion under which head its uses are referred to in detail. (See p. 246.)

### QUASSIÆ\* LIGNUM.

*Origin.*—The *Picræna excelsa*, N. O. Simarubaceæ, or *bitter ash*, is a lofty tree, bearing polygamous flowers, and is a native of Jamaica and the Caribbean Islands.

Surinam bitter wood is derived from *Quassia amara*, the original source of quassia.

*Characters.*—The wood comes to the market in cylindrical billets of various sizes, but is commonly seen in small chips or raspings. An efflorescence of nitrate of potash is frequently observed on it. It is readily distinguished from other woods by its white colour which becomes yellow on exposure, and by its intensely pure bitter taste. The wood quickly imparts its bitterness to cold water (*Infusum*), and to spirit (*Tinctura*). It contains a bitter crystalline principle termed *quassin*,  $C_{10}H_{12}O_3$ . The so called “bitter cup” is made from quassia wood. It is a curious circumstance that the addition of a little potassic permanganate to infusion of quassia immediately renders it almost tasteless.

\* From Quassi, the name of a Surinam negro, who about the middle of the last century acquired some reputation in the treatment of malignant fevers by a secret remedy which proved to be a species of *Quassia* or *Picræna*.

The wood is destitute of tannic acid, and hence its preparations will not discolour salts of iron.

*In Medicine.*—A useful, simple bitter tonic, unattended with astringency, acidity, or aroma, and well adapted to dyspepsia, and other conditions requiring a gentle stimulant to the digestive functions. It acts as a poison on insects and other small animals, and according to some observers, even on rabbits and dogs.

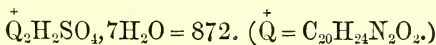
### QUERCUS CORTEX.

*Origin.*—The genus *Quercus*, N. O. Cupuliferæ (Amentaceæ), comprises a large number of species, two of which are in the Pharmacopœia, viz., *Q. infectoria*, from which galls are derived (see *Galla*), and *Q. pedunculata*, the common British oak.

*Characters.*—Oak bark is distinguished from the other barks by its grey, shining epiphloeum, or outer bark. Its astringency is due to tannic, gallic, and quercitannic acids, which exist most abundantly in the younger bark in the spring season; hence the officinal directions for its collection.

*In Medicine.*—As an astringent and tonic, oak bark is seldom prescribed internally, but it is sometimes used as an injection in leucorrhœa, prolapsus ani, &c.

### QUININÆ SULPHAS.



*Origin.*—Sulphate of quinia, or as it is usually called, *quinine*, is derived from the bark of *Cinchona Calisaya*, and *C. lancifolia*, N.O. Cinchonaceæ. These kinds contain quinia in the largest proportion, and most free from admixture with cinchonia (see *Cinchona*).

*Preparation.*—Quinia, as well as the other alkaloids, exists

in the bark in the state of kinate and tannate, and the main steps of the process for its extraction are as follows:—

(a). Exhaust the powdered bark thoroughly of all its active ingredients, by means of dilute hydrochloric acid; (b) precipitate the resulting solution of hydrochlorates of quinia, &c., by excess of solution of soda. The excess of soda holds in solution the tannin, also the colouring and resinous matters, but does not dissolve the quinia. (c) Redissolve the precipitated quinia, &c., gradually by the aid of heat in the proper proportion of dilute sulphuric acid. The neutral sulphate crystallises out on cooling in silky acicular crystals, and the salts of the other alkaloids, viz. cinchonia, quinidia, and cinchonidia, being much more soluble, remain for the greater part behind in the mother liquor.

100 parts of yellow bark yield on an average about 2·5 or 3 parts of sulphate of quinia.

*Characters and Tests.*—The delicate, silky, flexible, needle-shaped crystals are easily distinguished by their intensely bitter taste, although almost insoluble in cold water; about 1 part in 800. Even in the weak aqueous solution the evidence of its being a sulphate is given by its affording a white precipitate with chloride of barium. The colour test for quinia consists in the production of a green precipitate (*thalleiochine*), on the addition of chlorine solution *followed by ammonia*. Cinchonia does not give a green colour under similar conditions. Alcohol dissolves the salt more readily than water, e. g. Tinct. Quiniæ, 8 grs. to 3i; and dilute acids, even tartaric, and citric (as in Vinum Quiniæ), dissolve it with facility. Excess of ammonia also dissolves quinia, e. g. Tinct. Quiniæ Ammoniata. The officinal salt is a neutral sulphate, but is at once converted on the addition of a little dilute sulphuric acid into an acid sulphate,  $\bar{Q}$ ,  $H_2SO_4, 7H_2O$ , which is freely soluble in water, and is the form in which the drug is commonly prescribed. The solution in sulphuric or any other *ox-acid* exhibits a beautiful blue tint by *reflected* light, i. e. it is fluorescent, but this

fluorescence is not developed with a haloid acid, e. g. hydrochloric, and it at once disappears if a grain or two of any haloid salt, e. g. KI, be added to the sulphuric acid solution. A solution of sulphate of quinia acidulated with sulphuric acid, when exposed to sunlight, becomes brownish red, and suffers the loss of the greater part of its quinine, which is replaced by another alkaloid corresponding to quinicine. (Hesse.)

Sulphate of quinia may be impure from the presence of various substances :—

*Cinchonia*, which is best detected by Liebig's test : precipitate the alkaloid from the sulphuric acid solution by ammonia, and treat the precipitate with ether. If the precipitate be pure quinia it entirely dissolves, but the slightest trace of cinchonia will appear as a crystalline layer at the line of separation of the ether and the solution of sulphate of ammonium.

*Quinidia*, if present, would, under similar circumstances, appear as an oily substratum. Other adulterants are *sulphate of lime*, detected by its non-dissipation at a red heat ; *salicin*, which strikes a red colour when warmed with strong sulphuric acid (as also veratria and narcotin) ; and various organic matters, such as *sugar, gum, starch, stearin*, &c. The pure salt, when heated to  $212^{\circ}$ , becomes luminous, especially if rubbed, and loses all its water of crystallisation, i. e.  $\frac{1}{7}$  of its weight. If kept in a moist atmosphere it is liable to absorb a considerable additional amount of water. At a higher heat it melts, assumes a fine red colour, and, if ignited on platinum foil, burns entirely away. Under certain conditions, acid sulphate of quinia gives with iodine a crystalline deposit of iodo-sulphate of quinia, or *herapathite*,  $\left\{ \begin{array}{l} 4\text{Q}, 3\text{H}_2\text{SO}_4, \\ 6\text{I} + 3\text{H}_2\text{O} \end{array} \right\}$ , which polarises light five times more strongly than tourmalin.

*In Pharmacy*.—There are three spirituous solutions of quinia, viz., the Tincture, Ammoniated Tincture, and Wine, the two former of which are eight times the strength of the latter. In

prescribing sulphate of quinia in combination with other drugs, it is well to remember the facility with which the salt is decomposed. Quinia, like all alkaloids, is precipitated by a number of substances, e. g. alkalies and their carbonates, tannic acid, astringent infusions and decoctions, tincture of iodine, &c. Permanganate of potash converts quinia into a new base, devoid of taste.

*In Medicine.*—The principal effects and uses of Quiniæ Sulphas have been already given under Cinchona, and for evident reasons the salt has to a large extent displaced the more bulky and nauseous preparations of bark.

Devoid of the aromatic and astringent qualities of the bark, sulphate of quinia is less liable, in small doses, to produce local irritation of the stomach and bowels.

An erythematous, itchy rash, resembling measles or scarlatina, has occasionally been observed as the result of very small doses of quinine, in susceptible persons.

*Administration.*—May be given in pill, but the solution in water, acidulated with sulphuric acid, is usually preferred. One or 2 m. of the dilute acid may be added for each gr. of the salt.

It is occasionally employed as an injection into the rectum, and of late years attention has been drawn to its hypodermic use in intermittent fevers and other diseases, as affording some special advantages. About  $\frac{1}{2}$  or 1 gr. of the sulphate, in aqueous solution, may be injected at a time.

Other salts have been proposed as improvements upon the sulphate—viz. the muriate, citrate, valerianate, and tannate; but, excepting the point of relative solubility, there is no good reason for believing that it signifies much with what acid the alkaloid is united.



## RESINA.\*

*General Characters of Resins.*—Resins are vegetable products, solid, fusible by heat, which distinguishes them from gums, but never becoming completely fluid, which distinguishes them from fatty bodies; inflammable, insoluble in water, soluble in alcohol, chloroform, ether, fatty and bituminous substances; of variable colour, but generally yellow; brittle, heavier than water. They are probably derived from the oxidation of volatile oils. (Dorvault.)

*Origin.*—The turpentine which exudes from the wood of various species of *Pinus* and of *Abies*, N.O. *Coniferæ*, is an oleo-resin of about the consistence of fresh honey. When this is distilled, the essential or volatile oil (spirits of turpentine) comes over, and a residue of resin (resin or colophony) remains in the still. (See *Oleum Terebinthinæ*.)

*Characters.*—Common resin is of various colours and degrees of transparency, from dark brown to nearly white, according to the heat employed and the amount of water included.

American resin is much purer than the English. The chief constituents of resin are pinic acid ( $\text{HC}_{20}\text{H}_{29}\text{O}_2$ ), and its isomers, sylvic and pimaric acids.

Like other resinous bodies, it is insoluble in water, but soluble in spirit, and also in oil of turpentine. Sulphuric acid colours it red.

*In Pharmacy.*—Occurs in most of the Plasters of the B. P., but is never used internally. It is said to aid in the preservation of ointments by hindering the oxidation of fatty substances.

## RHAMNI SUCCUS.

*Origin and Characters.*—The purging buckthorn, *Rhamnus catharticus*, N.O. *Rhamnaceæ*, is a native of Europe, and occurs as

\*  $\rho\acute{\iota}\omega$ , to flow; because it exudes from trees.

a spinose shrub, with diœcious flowers, and black, smooth, shining berries, which contain four seeds each. The expressed juice is dark green, with an unpleasant odour, and a bitter, acrid, nauseous taste. It becomes gradually red, owing to the development of acetic acid in it, and it contains a glucoside, *rhamnin*. Evaporated to dryness with the addition of lime, it constitutes *sap green*.

*In Medicine*.—Both the berries and their expressed juice are active hydragogue cathartics, occasionally given in dropsy, but the Syrup is rarely prescribed, for it is apt to occasion nausea and troublesome griping. The dose of the syrup is ʒi, and ginger and allspice are added to it as correctives.

## RHEI RADIX.

*Origin*.—A number of species of the genus *Rheum*,\* N. O. Polygonaceæ, are known to botanists, but, notwithstanding the length of time that rhubarb has been in use, the precise plant from which the Asiatic drug is derived has, owing to various circumstances, been a matter of obscurity. From the year 1732, up to the present time, numerous inquiries have been made, and different plants have been credited with the origin of this familiar drug, and it is only very recently that M. Baillon has referred the true plant, a native of Thibet, to *Rheum officinale*. The common garden rhubarbs, the leaf stalks of which are so commonly used for culinary purposes, are stated to belong to *R. Rhaponticum*, *R. hybridum*, *R. compactum*, and intermediate varieties of them. The cultivated plant has a strong tendency to form hybrids.

The root is not collected till the plant is six years old, and after being cleaned and deprived of its cortical portion, and of

\* From *Rha*, an old name for the Volga, from whose banks it was first brought; or, from *ῥέω*, to flow.

the smaller radicles, it is divided into pieces of convenient size and dried.

*Characters.*—Rhubarb is at once marked out from all other roots by its disagreeable nauseous odour and yellow colour. The irregularly rounded pieces are frequently bored with one or more holes, intended for convenience of suspension during the drying process, or as a means of ascertaining their soundness. Although the stems contain acid oxalate of potassium, to which they owe their sour taste, the root contains abundant conglomerate crystals (raphides) of insoluble oxalate of calcium, and accordingly it is finely gritty under the teeth. The crystals may be detected when thin slices of the root previously boiled in water are examined by the microscope.

Inferior rhubarb is often decayed, worm eaten, or powdered, and adulterated with turmeric. In the latter case the fraud is detected by the brown colour developed on the addition of boracic acid which does not affect pure rhubarb. Alkalies, which turn the yellow turmeric brown, could not be used as a test, because they affect rhubarb similarly.

The principal commercial varieties of rhubarb are (1) Chinese; (2) Russian; and, (3) European, the relative characters of which are briefly shown in the following table.

ASIATIC.		EUROPEAN.
CHINESE.	RUSSIAN. (TURKEY RHUBARB.)	
In cylindrical or rounded pieces, sometimes flattened at one or both sides.	In irregular and angular pieces.	In sticks or cylindroid pieces.
Exterior, dull brownish yellow; reticulated appearance.	Exterior brighter yellow.	Exterior reddish or brownish yellow. Striated or dotted, not reticulated.
Broken surface ragged, uneven, and irregularly variegated. Small, stellate circles.	Broken surface similarly variegated. Stellate circles, especially near circumference.	Broken surface radiated, in regular lines. No stellate spots.
Generally perforated with small holes.	Pierced with large holes, often reaching only to the centre.	Not pierced.
Heavy and compact.	Less compact and heavy.	Spongy and less compact.
Gritty when chewed.	Gritty when chewed.	Not gritty under the teeth. Contains more tannin and starch.

From various causes, none of the European rhubarbs equals the Asiatic drug in purgative power.

The chemistry of rhubarb is involved in much obscurity notwithstanding many attempts at its analysis, and its purgative property has not, so far, been satisfactorily associated with any definite active principle or principles. Its astringency is doubtless due to tannic acid, of which it contains a considerable amount, and which precipitates ferric salts of a green colour.

The chief source of the yellow colour of rhubarb, is chrysophanic acid (*χρυσός, φαίνω*), to which a number of synonyms belong; and in addition, three resinous colouring matters, and a bitter substance, are recognised as among the more important ingredients of rhubarb root. Chrysophanic acid is turned red by alkalies.

*In Pharmacy.*—Rhubarb yields its active properties to water (e. g. Infusion), and to alcohol (e. g. Tincture, and Wine).

The proportion of rhubarb in the Pil. Rhei Co., and the Pulv. Rhei Co., is almost identical, i. e. about 1 in 4. The Tincture is four times, and the Wine is three times as strong as the Infusion.

*In Medicine.*—A useful and familiar purgative, and valuable also on account of its tonic-astringent qualities, combined with its cathartic power. By roasting, its purgative property is said to be diminished or lost, and it becomes more astringent. It is a moderately active and safe purgative, not causing watery evacuations, and is frequently combined with other purgatives, e. g. aloes in the Pil. Rhei Co. It seldom gripes, and the addition of an aromatic will effectually prevent this from occurring. Its colouring principle is absorbed, for it is stated to occasionally stain the axillary perspiration yellow, and it communicates a dusky red colour to the urine, in which it may be easily detected by the addition of ammonia, which materially deepens the colour of the urine, an effect not produced if the original colouration were due to blood, or urinary pigment.

Rhubarb is frequently employed to remove simple fæcal accumulations, and in dyspeptic constipation; in the acid diarrhœa and indigestion of children, Gregory's powder (Pulv. Rhei Co.) is a remedy of acknowledged efficiency.

Small doses, combined with aromatics and astringents, are often prescribed with advantage in diarrhœa and dysentery. Two or 3 grs. of calomel, and 3 grs. of Pil. Rhei Co., constitute a good purgative combination.

The preparations most in use are the Infusion, Pill, Compound Powder, and Tincture. A "Haustus Rhei" (i. e. infusion of rhubarb with a saline purgative, e. g. sulphate of potassium, and an aromatic) is a common prescription. The least nauseous mode of giving rhubarb is to rub up 10 grs. of the powdered root with 10 grs. of Sodæ Bicarb., and diffuse in 3i. of peppermint water; to be taken *soon after it is prepared*. Four grs. of powdered rhubarb and 1 m. of glycerin, make a nice pill (Squire).

### RHŒADOS PETALA.

*Origin*.—The red or corn poppy, Papaver Rhœas, N. O. Papaveraceæ, is a native of Europe, where it grows wild in great abundance, and forms a conspicuous object in the fields of grain, with its upright, hairy stem, and bright scarlet petals.

Although the capsules contain the same kind of milky juice as that found in the opium poppy, P. somniferum, the quantity is so small, and the amount of included morphia so minute, that it is not worth extracting. The petals are the only officinal part.

*Characters*.—The fresh petals possess a full scarlet colour, a heavy narcotic odour, and a slightly bitter taste, but when dried, they lose their odour and assume a dusky red colour. Acids brighten the colour, alkalies deepen it, and ferric chloride produces a dark violet or brown tinge. The petals do not contain a trace of morphia. (Attfeld.) They are said to contain a non-poisonous alkaloid, *rhœadin*  $C_{21}H_{21}NO_6$ .

*In Pharmacy*.—The petals are used only as a colouring agent, in the form of syrup.



## ROSÆ CANINÆ FRUCTUS.

## ROSÆ CENTIFOLIÆ PETALA.

## ROSÆ GALLICÆ PETALA.

*Origin and Character.*—The three officinal species of *Rosa*, N. O. Rosaceæ, are of no medicinal importance, and will be briefly noticed together. (1) The dog rose,\* or wild brier, *R. canina*, bears a smooth, oval, red fruit, of an agreeable sweet subacid taste, due to the presence of 30% of inverted sugar, and of citric and malic acids. (2) The cabbage rose, *R. centifolia*, bears large flowers, with many petals, generally of a pale red colour, but subject to many varieties. The flowers owe their fragrance to a volatile oil, which may be separated in minute quantity by distillation with water, and which is known as *otto* or *attar* of roses. This oil is peculiar in consisting of a *solid* hydrocarbon,  $C_8H_{16}$ , which is destitute of odour, and of an oxidised portion, which is liquid, and is the source of the odour. The petals may be preserved fresh for a considerable time, by compressing them with alternate layers of common salt in a well closed vessel (see *Aqua Rosæ*).

(3) The red or French rose, *R. Gallica*, bears very large flowers, with rich crimson petals, not so numerous as in the cabbage rose, and less fragrant, but, unlike the cabbage rose, the fragrance is increased by desiccation. The petals contain sugar, along with gallic and tannic acids, and they are the most astringent of the three species, especially when collected before the flower expands. The petals lose their fine colour by exposure to light and air, and are apt to become mouldy.

*In Pharmacy.*—The confection either of hips (dog rose), or of the red rose, is used as a convenient vehicle for making up pill masses. Rose water forms an agreeable basis for collyria and

\* So called because the root was formerly esteemed an efficacious remedy against hydrophobia.

other lotions, and the acid infusion of roses, which is rendered bright red by the sulphuric acid, is an excellent menstruum for many tonic and astringent medicines, and for sulphate of magnesium.

### SABADILLA.

*Origin.* The sabadilla or cevadilla\* plant, *Asagrea† officinalis*, N. O. Melanthaceæ, is a native of the eastern slopes of the Mexican Andes, and is adopted in the Pharmacopœia solely as the source of veratria.

*Characters.*—In commercial specimens, the dark, scimitar shaped, wrinkled seeds are usually mixed with the fruit, which is easily recognised by its form, viz., three small cohering papery follicles, which are open above, and somewhat resemble the ripe fruit of monkshood. The most important constituents are from 0·3 to 0·4% of an acrid alkaloid, veratria,  $C_{32}H_{52}N_2O_8$ , which is in combination with gallic acid; and another alkaloid, sabadillin,  $C_{20}H_{26}N_2O_5$ .

*In Pharmacy.*—The seeds are employed only in the preparation of Veratria.

*In Medicine.*—The drug is now seldom or never used internally, but it is possessed of violent emeto-cathartic qualities, and has been known as a medicine for three hundred years. It has been recommended chiefly as an anthelmintic and for the destruction of vermin.

### SABINÆ CACUMINA.

*Origin.*—Two species of juniper are officinal—viz., the *Juniperus communis*, which yields *Oleum Juniperi*, and the *J.*

\* Spanish, *Cebada*, barley; from a fancied resemblance of the fruit.

† Named after the American botanist, Asa Gray.

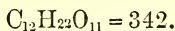
Sabina,\* N. O. Coniferæ. The latter is an evergreen shrub, having the male and female flowers on different plants, and bears an ovoid, fleshy, dark purple fruit about the size of a pea.

*Characters.*—The branches and tops are distinguished from those of the common juniper by their minute imbricated leaves in four rows. Their most important constituent is an acrid, heavy smelling, volatile oil (*Oleum Sabinæ*). When in very coarse powder, or in fragments, the microscope shows the presence of the circular discs, so characteristic of the wood cells of the Coniferæ (Pereira). Both the taste and odour are very disagreeable.

*In Medicine.*—A powerful stimulant and irritant, but rarely prescribed now, although it has been much vaunted as an emmenagogue in amenorrhœa, and has been recommended in chronic rheumatism and gout. Overdoses of it are capable of causing dangerous gastro-intestinal inflammation, and it is sometimes criminally employed to procure abortion.

The ointment is occasionally useful as an external irritant, to maintain a discharge from blistered surfaces (*open blister*), and as an application to obstinate ringworm of the head.

## SACCHARUM† PURIFICATUM.



Several varieties of sugar are mentioned in the British Pharmacopœia, and they are frequent constituents of vegetable juices. In fact, there are few plants from which sugar is absent, and to which at some period of their growth it does not form an important article of nutriment. Cane sugar also occurs in *recent* honey, and from the honey of an American wasp, *Polybia apicipennis*, large crys-

\* Because employed by the Sabine priests in their ceremonies.

† *Sacchar*; Arabic.

tals of cane sugar often separate. Accordingly, before referring to any of them in particular, a brief sketch of the general characters of this important group of compounds will be given.

More than a dozen sugars are known to chemists, some of them, however, being of little importance. They are all carbo-hydrates, i. e. are composed of C, H, & O, and correspond to the general formula,  $C_mH_nO_n$ .

The H & O are present exactly in the proportions requisite to form water, and the number of atoms of C is always 6, or a multiple of 6. The gums, starches, and celluloses, likewise belong to the class of carbo-hydrates. Roughly speaking, it may be said that the celluloses and starches are insoluble in cold water and in spirit; the gums are soluble in, or gelatinise with cold water, but are insoluble in spirit; and the sugars are soluble in water, and also in spirit to a limited extent.

It will be seen from the table that, although the sugars differ but little in their chemical composition, they differ considerably in external appearance and in chemical characters. Moreover, several of them admit of being readily transformed one into the other by the addition or abstraction of  $nH_2O$ , and some of them undergo fermentation with facility, while others do not. They are all soluble in water, and form sweet solutions, cane sugar being by far the sweetest variety.

In their chemical relations they are ranged with the large class of alcohols, of which, we have in the Pharmacopœia, e. g. spirit of wine, fousel oil, and glycerin; because the sugars undergo decompositions similarly to common alcohol, and furnish parallel series of bodies. Thus, with oxacids, they yield compound ethers, called the glucosides. In the subjoined tabular view the principal characters of the four chief forms of sugar are contrasted:—

1. SUCROSE. (CANE-SUGAR.) $C_{12}H_{22}O_{11}$ .	Obtained from sugar cane, beet root, and sugar maple. Forms chief portion of pulp of Cassia fistula, and occurs in carrot, turnip, maize, many fresh fruits, &c. Converted by dilute acids into "inverted sugar."*	2. (a) GLUCOSE (DEXTROSE, OR GRAPE-SUGAR.) $C_6H_{12}O_6$ , $H_2O$ . (b) LEVULOSE. $C_6H_{12}O_6$ .	3. LACTOSE. (MILK-SUGAR.) $C_{12}H_{22}O_{11}$ , $H_2O$ .	4. MANNITE. $C_6H_{14}O_6$ .
		Obtained usually from starch by dilute acids. Occurs in diabetic urine, dried fruits, e. g. raisins and figs, &c.  Glucose + levulose† = "inverted sugar" (uncrystallisable) which occurs in honey, treacle, and in many fresh fruits. Not charred by cold $H_2SO_4$ .	Obtained only from the milk of animal. Less soluble in water than either (1) or (2), and is only very slightly sweet. Not soluble in spirit.  Charred by hot $H_2SO_4$ .  Do., do.  Turned yellow when boiled with KHO. Crystallises in four-sided prisms.	Obtained from manna.  Exists in a great number of vegetables, e. g. celery, onions, asparagus, certain fungi, and sea weeds, and in the exudations of apple and pear trees.  ‡ Not charred by $H_2SO_4$ , hot or cold. Does not reduce an alkaline solution of potassio-cupric tartrate, on boiling. Not altered in colour when boiled with KHO. Crystallises in silky four-sided prisms.
		Reduces an alkaline solution of potassio-cupric tartrate, on boiling. Turned brown‡ when boiled with KHO. (Moore's test.) Glucose crystallises in cubes or square tables.		
		Does not reduce an alkaline solution of potassio-cupric tartrate, on boiling. Not altered when boiled with KHO. Crystallises in four or six-sided rhomboïdal prisms.		

\* So called because its action on polarised light is *inverted*, i. e. it turns the ray to the left instead of to the right. The amount and kind of sugar present in a solution, e. g. molasses, can be determined optically.

† Glucose and levulose are not convertible the one into the other, but each of them can be obtained from sucrose.

‡ Trommer employed  $CuSO_4 + KHO$ . Different modifications of the blue tartrate solution are known under the names of Fehling's, Barreswill's, and Trommherz' liquids.

§ The brown solution contains *melassic acid*, and *glucic acid*.

*Preparation of cane sugar.*—The expressed juice of the sugar cane is immediately mixed with a small proportion of lime, and evaporated to a proper consistence, whereby the *brown sugar* of commerce is obtained. This, when redissolved, filtered through animal charcoal, evaporated to a strong syrup, and crystallised in conical moulds, forms the loaves of *white* or *lump* sugar. The coloured syrup which drains off, and which contains chiefly uncrystallisable sugar, derived from the sucrose, forms treacle (Theriaca), or molasses. In France, much cane sugar is prepared from beet juice; and the sugar maple, sugar millet, maize, and sugar palm, all contain large quantities of sucrose.

*Characters.*—The properties of ordinary white sugar are universally familiar, and it will be sufficient to remark that it dissolves readily in half its weight of cold water, and that it becomes phosphorescent by rubbing pieces together or breaking it. It is well known that sugar, when finely pulverised, does not taste so sweet as before. When a syrup of it (i. e. a strong solution) is slowly cooled, large crystals, termed *sugar candy*, are deposited. Melted, and suddenly cooled, it forms a transparent amorphous mass, called *barley sugar*, and in time, the crystalline structure of the sugar is gradually recovered. At a higher temperature, above 400° F., it blackens and yields a porous dark mass, containing a mixture of several compounds, and known as *caramel* (Saccharum ustum), used as a colouring agent for chlorodyne, &c., and in culinary operations. The solution is not precipitated by subacetate of lead, a negative property which distinguishes sugar from many other organic principles. The tests for distinguishing cane from grape sugar have been already given at p. 597. Cane sugar in watery solution becomes slowly converted into “inverted sugar,” and much more quickly when heated with dilute acids. When fermented with yeast, cane sugar first passes into inverted sugar, and then yields alcohol and carbonic acid.

*In Pharmacy.*—Sugar fulfils some important uses. Thus, (*a.*)



it tends to preserve ferrous salts from oxidation into ferric salts, e. g. Ferri Carb. Sacch., Mist. Ferri Co., Pil. and Syr. Ferri Iodidi, and Syr. Ferri Phosphatis. It is worth remembering that by prolonged contact with sugar, corrosive sublimate is transformed into calomel.

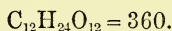
(*b.*) It unites with various bases in definite proportions, e. g. lime, and greatly increases its solubility in water, for Liq. Calc. Sacch. contains  $12\frac{1}{2}$  times as much lime as Liq. Calcis.

(*c.*) It serves to render oils and resins miscible with water, e. g. Mist Guaiaci, and gives consistence and bulk to various preparations, e. g. Lozenges.

(*d.*) In Confect. Rosæ, Conf. Sennæ, and Pulv. Glycyrrh. Co., it preserves them from change (hence the old term *conserve* for confection), for sugar is a powerful antiseptic, and is often used for preserving meat, fish, and milk.

*In Medicine.*—Cane sugar, when ingested, is converted into grape sugar in the organism, but if introduced directly into the blood, it passes, in part at least, unchanged into the urine. In frogs, fishes, and rabbits, saturation of the blood with sugar causes cloudiness of the crystalline lens, similar to that produced by chloride of sodium. Taken in excess, sugar is partially transformed into lactic acid, and so disturbs the digestive functions. Of its uses and applications in respect to diet it is needless to speak, but it may be mentioned that the popular notion that sugar is injurious to the teeth is unfounded, at least from its moderate use. As a demulcent, in the form of candy, &c., it is in general favour in catarrhal and irritative affections of the chest and throat, is sometimes dusted over ulcers of the larynx, and on corneal opacities, and has been successfully used to remove lime stains from the cornea.

## SACCHARUM LACTIS.



*Preparation.*—Coagulate milk by the addition of a little dilute sulphuric acid, separate the curds, evaporate the resulting whey to a syrupy consistence, and allow it to crystallise slowly, a cord or stick being placed in the solution to serve as a nucleus for the aggregation of the crystals. This sugar constitutes about 5% of the milk, and is manufactured largely in Switzerland and Bavaria.

*Characters.*—A very hard, gritty substance, slowly soluble in 6 parts of cold, and 3 parts of boiling water. It is not susceptible of the alcoholic or vinous formation by the direct influence of yeast, but by treatment with dilute acids, it is converted into a variety of grape sugar, termed *galactose*.

*In Pharmacy.*—Occasionally used as an aid to the trituration of other drugs, and as a means of diluting more potent solid medicines, e. g. elaterium (Pulv. Elater. Co.), santonin, and various powders intended for laryngeal insufflation, for which purpose its unirritant qualities render it suitable.

*In Medicine.*—It has been proposed as an article of diet in chronic pulmonary diseases, but has never come much into use, nor is it easy to see what special advantage it would be likely to confer.

## SAMBUCI FLORES.

*Origin.*—The common wild elder, *Sambucus*\* *nigra*, N. O. Caprifoliaceæ, is a small tree, which bears globular, deep purple berries.

*Characters.*—The flowers are small, white when recent, yellow when dried, and while fresh have a heavy, nauseous odour,

\* *Sambuca*, a musical instrument, also an engine of war; because both were formed from this tree.

which becomes more fragrant on drying. By distillation they yield a small proportion of volatile oil, which on cooling assumes a firm consistence. The oil contains a hydrocarbon, *sambucene* ( $C_{10}H_{16}$ ), and perhaps a camphor, i.e. an oxygenated portion.

*In Medicine.*—Aqua Sambuci is occasionally used as a vehicle for lotions and collyria, but possesses no particular efficacy. The berries and inner bark are cathartic, and the leaves have caused severe irritant poisoning in a child.

## SANTONICA.

*Origin.*—The plant from which Santonica\* is derived has been ascribed to several species of the genus *Artemisia*,† N. O. Compositæ, but its precise origin is still a matter of uncertainty. Petzholdt has recently referred it to *Artemisia Cina*.

*Characters.*—From its appearance and use, this drug is popularly termed *Wormseed*, but it really consists of the minute unexpanded flowers and short broken stalks of the plant, often mixed with the seeds, and the very small, obtuse, smooth leaflets. The size of the flowers can be imagined, when it is remembered that four or five are crowded together in a little cluster,  $\frac{1}{12}$  inch long by  $\frac{1}{24}$  inch broad.

There are two varieties of the drug—viz. (a) *Levant* (Aleppo or Alexandria) wormseed, which is the officinal kind, and in which the small florets are more conspicuous; its true place of origin is Persia and Bucharía; and (b) *Barbary* wormseed, distinguished by the flowers being wanting, or in the form of minute *globular buds*, and by the hairy down covering these parts. Each variety possesses a similar aromatic odour and taste, but it is stated that Barbary wormseed contains no san-

\* *Santonía*, its native place.

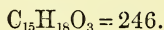
† *Artemisius*, a hill of Arcadia.

tonin. Levant wormseed contains a volatile oil and a resinous matter, but its most important constituent is a white crystalline principle termed *santonin*.

*In Pharmacy*.—Yields Santonin.

*In Medicine*.—As a vermifuge it is superseded by santonin.

## SANTONINUM.



*Preparation*.—Santonin is erroneously defined in the British Pharmacopœia as a neutral principle, for it is really a weak acid insoluble in ammonia, but forming a soluble salt with lime. It is sometimes, and with more correctness, called *santonie acid*. Mialhe's process, that followed in the British Pharmacopœia, consists essentially of three steps—(1) The santonica is boiled with milk of lime, whereby soluble santionate of calcium is formed. (2) To the strained and concentrated solution, hydrochloric acid is added, which precipitates the santonin. (3) The precipitate is collected on a filter, washed with ammonia to remove resin and all traces of hydrochloric acid, dissolved in hot spirit, and finally filtered through animal charcoal to get rid of colouring matter. The spirituous solution is then set aside to deposit crystals of santonin, and this is finally purified by re-crystallisation; these operations being carried on in the dark. Wormseed yields from 1·2 to 2·3% of santonin.

*Characters and Tests*.—Santonin is at once known by its snow white, nearly tasteless, square tabular crystals, which turn canary yellow on exposure to light.

According to Sestini, santonin is changed by light into formic acid, a red resin, and photo-santonie acid, a crystallisable substance much more soluble in alcohol and ether than santonin itself. This change in colour is entirely caused by the chemical rays of sunlight, and is not due to any oxidation. It

will not occur with santonin placed in a strong solution of nitrate of uranium, which does not allow the passage of the actinic rays.

Santonin has been adulterated with powdered gum and with boracic acid; the former detected by its solubility in water, and the latter by the green colour communicated to the flame of alcohol into which it has been introduced.

It is nearly insoluble in cold water, about 1 in 5000, and its best solvents are hot spirit and chloroform. Its ethereal and alcoholic solutions are decidedly bitter. It can be volatilised by a moderate heat without undergoing decomposition, but at a red heat it is entirely burnt off. Although indifferent to test paper, it forms crystallisable and soluble salts with the fixed alkalies, and is soluble in a solution of twice its weight of carbonate of sodium, forming  $C_{15}H_8O_3, NaHO$ . It is very strongly lævogyrate, and when boiled with dilute sulphuric acid it is resolved into a resinous substance, termed *santoniretin*, which re-crystallises from spirit of wine with the unaltered properties of santonin.

*In Medicine.*—Large doses of santonin act distinctly on the nervous system, and produce a sense of depression and prostration, nausea, vomiting, giddiness, headache, and various disorders of the nerves of special sense. Not a few cases of poisoning, and some deaths, have occurred from the incautious medicinal use of santonin; but in some instances at least, strychnia has been mixed with or accidentally substituted for it. Occasionally, vomiting and urticaria have been observed to follow the use of santonin.

Two very singular effects are known to result from its administration in moderate doses, viz., visual derangements, and a peculiar alteration in the colour of the urine. Of the former, the most common is yellow vision (*xanthops*), i. e. all objects appear discoloured, a sort of temporary Daltonism being probably set up. The author has observed this effect after swallowing 5 grs., and it seems nearly constantly to follow a full dose of

santonin. Not unfrequently violet sight is induced. The error in sight is not due to colouration of the media of the eye, but appears to depend upon a temporary acquired blindness to one or more colours of the spectrum. Besides the visual faults, true optical hallucinations may occur; and in addition, hallucinations of smell and taste have been observed. The urine is usually coloured saffron yellow, or greenish yellow, not unlike bilious urine. A very delicate test for its presence in that secretion is afforded by the addition of any alkali (Rose), which immediately strikes a clear red with santonin urine. The nature of the colouring matter is not known. This colouration with an alkali might possibly lead to the erroneous inference of the presence of sugar in the urine. Notwithstanding the sparing solubility of santonin, it can be thus detected within ten minutes after 4 grs. have been swallowed, and within one hour after 1 gr. For ordinary doses of from 3 to 6 grs., about two days are required for its elimination, and it is to be remarked that the urinary colouration and reaction to the alkali test are much more persistent than the phenomena connected with vision.

When santonin is swallowed after having already turned yellow, the urine is not affected in colour, and vision is not disturbed. (Giovanni.)

The chief therapeutic use of santonin is, as an anthelmintic, especially against the round worm (*Ascaris lumbricoides*), and it is also used to expel the thread worm (*Oxyuris vermicularis*), which however, Rose states, is not affected by santonin. Its efficacy is widely attested, and the convenience and readiness of its administration favour its general employment.

Besides its use as a vermifuge, santonin has been recommended in some forms of amblyopia, and as a diuretic. It sometimes produces an almost uncontrollable desire to micturate. For a young child, the dose is 1 or 2 grs., twice a day; for an adult from 3 to 5 grs., beyond which quantity it would not be prudent to press it. It may be given in powder mixed with cane sugar or



sugar of milk, as santonate of sodium, in enema dissolved in castor oil, or to children, spread on bread and butter. It is best administered at bed time.

## SAPO\* ANIMALIS.

### SAPO DURUS.

### SAPO MOLLIS.

The term *soap* is popularly applied only to certain soluble compounds which form a lather with water, and which are used for cleansing purposes. But in chemistry, the word is used in a more extended sense as a generic term, and means the product obtained by the addition of a moist metallic oxide or hydrate to any fixed oil or fat. All ordinary fats are salts, composed of a fatty acid (palmitic, oleic, or stearic) in union with glycerin, and *saponification* essentially consists in the union of the metallic base with the fatty acid, the glycerin being therefore necessarily set free. Soaps vary in appearance and consistence, partly owing to the nature of the fat from which they are derived, and partly, to the base employed. Thus a soap is harder and less soluble the more stearate or palmitate it contains, and softer and more soluble when the oleate predominates; and again, soda soaps are harder than potash soaps. Soaps are either soluble or insoluble in water: those made with alkalies being soluble, and all others insoluble.

The following table exhibits the names and composition of the soaps occurring in the Pharmacopœia :—

\* Σήπω, to putrefy; from the disagreeable smell produced in making it.

## SOLUBLE.

1. Sapo Animalis, i. e. stearate of sodium.
2. Sapo Durus, i. e. oleate of sodium.
3. Sapo Mollis, i. e. oleate of potassium.
4. Linim. Ammoniaë, i. e. oleate of ammonium.\*

## INSOLUBLE.

1. Emplastrum Plumbi, i. e. oleate of lead.
2. Linim. Calcis, i. e. oleate of calcium.

*Soap making.*—The process for making pure hard soap is in outline as follows:—Olive oil is first boiled with solution of soda, until the whole forms a thick, stringy mass. The next step consists in the addition of salt, in which the soap is insoluble. The soap is thus separated from the alkaline impurities, the glycerin rises to the surface, is ladled out, and the soap, when cool, is cut into bars. Potash soap cannot be precipitated by chloride of sodium, because decomposition ensues, and a hard soda soap is thrown down. The common soap of commerce, or the officinal Sapo Animalis, is made from all varieties of oil, e. g. tallow, fish oil, refuse fat and grease, rape and hemp seed oil, &c. Commercial soft soap is often brown or yellow, and possesses a disagreeable, rancid odour. A great variety of fancy and ornamental soaps are prepared by slight modifications in the process.

*General properties of soap.*—The common kinds, i. e. potash and soda soaps, are readily soluble in water and alcohol, are somewhat heavier than water, and are decomposed by acids and by most metallic salts. The former combine with the alkali of the soap, and so liberate the fatty acid of the soap; the latter give rise, by double decomposition, to an insoluble soap of their base, and a soluble compound of their acid with the alkali of the soap.

\* Linim. Hydrargyri is essentially an emulsion of metallic mercury with camphorated ammonia soap (oleate and stearate of ammonium).

For example, a *hard* water, i. e. one which contains calcium or magnesium in abundance, decomposes and curdles soap by forming with it an insoluble oleate of calcium or magnesium. The efficacy of soap as a cleansing agent depends upon its power of rendering grease and other soiling matters soluble in water, and therefore capable of being removed by washing. The distinctive characters of potash and soda soap will be best shown by contrasting them in parallel columns—

SAPO DURUS.	SAPO MOLLIS.
(Castile, Spanish, Curd Soap.)	(Green Soap, Black Soap.)
Made with olive oil or animal fat and caustic soda.	Made with olive oil and caustic potash.
Greyish white, firm and dry.	Yellowish green: a soft jelly. Inferior kinds are darker coloured.
Does not contain excess of alkali.	Contains an excess of alkali.
When burnt, leaves an ash of $\text{Na}_2\text{CO}_3$ , which does not become moist on exposure.	When burnt, leaves an ash of $\text{K}_2\text{CO}_3$ which absorbs water, and becomes moist on exposure.

*In Pharmacy*.—Soap is applied to various purposes in pharmacy. It is used to give a proper consistence to some plasters and liniments, and is a frequent ingredient in pill masses, especially those of an aloetic nature. Curd soap (*Sapo Animalis*) is preferable for this purpose, and for the preparation of liniments.

*In Medicine*.—Externally, soap acts as a mild stimulant, and the soap liniment of the Pharmacopœia is often used under the name of *opodeldoc* in sprains and bruises. A solution of soap, preferably soft soap, mixed with common salt, will cure itch and destroy bugs. In constipation, especially when arising from hardened and impacted feces in the rectum, a strong soap enema proves most effectual, and a lump of soap cut as to form a suppository, furnishes a simple and efficient means of promoting intestinal evacuation.

In cases of poisoning by the mineral acids, if no better ant-

acid be at hand, a solution of soap yields a ready antidote, and may be given very freely in the diluted state.

Of late years a number of medicated soaps have been introduced in the treatment of diseases of the skin, e. g. carbolic acid, juniper tar, &c.

### SARSÆ RADIX.

*Origin.*—Much uncertainty has from time to time prevailed as to the botanical origin of the different varieties of Sarsaparilla\* known to occur in commerce. The officinal plant, *Smilax officinalis*, N. O. Smilacæ, is a native of New Granada, in Central America. All the species are climbing or trailing plants, with prickly stems, and are distributed throughout Central and South America. *Smilax medica* and *S. papyracea* supply part of the sarsaparilla of commerce.

*Characters.*—The red or so called Jamaica sarsaparilla, as found in commerce, is in bundles from twelve to eighteen inches long, by four or five in diameter. These consist of long, slender roots folded up, with numerous small root fibres attached, and often include a portion of the root stock, or *chump*, as it is called.

Other varieties of sarsaparilla are distinguished by the names of the districts from which they come, such as Honduras, Vera Cruz, Brazilian (Lisbon), Guatemala, &c., and they differ slightly in their external characters. The root is wrinkled longitudinally, and is divisible into a thick outer portion or cortex, containing more or less starch, and an inner woody layer or medullium, which surrounds the starchy pith.

In the relative thickness of these different zones, particularly of the central medulla and of the ligneous portion, and in the microscopical characters of the cells surrounding the woody

\* Spanish, *Sarza*, a briar ; *parilla*, a little vine.

layer, are found the characters which distinguish one kind of sarsaparilla from another. (See figures in *Guibourt*, Vol. II.)

The *mealy* sarsaparillas, i. e. those containing abundant starch in the cortex, are the Brazilian, Honduras, Vera Cruz (Caracas), and Guatemala. The non-mealy kinds, with a thinner and darker bark, are the Jamaica and Lima sarsaparillas.

Sarsaparilla spoils by keeping, and moreover it is liable to substitution of other roots or those of inferior species of smilax. The root of the officinal *Hemidesmus Indicus*, known as Indian sarsaparilla, has been confounded with the true sarsaparilla.

The only criterion, and that not a very satisfactory one, of its quality, is the taste; it should leave a decidedly acrid sensation in the mouth after being chewed for a short time.

The chemistry of sarsaparilla is rather unsettled, but its most important constituent seems to be *sarsaparillin* (smilacin, or parallinic acid), a crystallisable neutral principle, bitter in solution.

*In Pharmacy.*—The drug parts readily with its properties to water, which consequently is the menstruum employed in the three officinal preparations.

*In Medicine.*—The physiological effects of sarsaparilla are not very marked, but in large doses it causes nausea, vomiting, debility, and loss of appetite. The diuresis and diaphoresis are secondary phenomena, and belong to the condition of nausea (Gubler).

Few medicines have undergone greater changes of reputation since the middle of the 16th century, when it was introduced into Europe as a remedy for the venereal disease. But on the whole, it may be said that a large mass of experience points to its being, in some conditions of the system, especially those of a cachectic kind, a valuable alterative tonic. Although, unlike other vegetable tonics, it possesses but little bitterness,

yet its continued and free use is sometimes marked by manifest improvement in the patient's condition, as evidenced by gain of appetite and flesh, increase of strength, and the relief or cure of various morbid symptoms, such as obstinate ulcers and eruptions of the skin.

It is principally used in the treatment of old venereal affections, and often proves salutary when mercury has failed, or is inadmissible, but it certainly has no claim to the position of a specific in syphilitic or other affections.

The Decoction may be given freely in  $\mathfrak{z}$ i. or  $\mathfrak{z}$ ij. doses, and of the Extr. Sarsæ. Liq., from  $\mathfrak{z}$ ij. to  $\mathfrak{z}$ iv.

Zittmann's decoction, lauded in Germany, as a remedy in tertiary syphilis, is a curious medley of sarsaparilla, alum, kino, oxysulphide of antimony, calomel, senna, and some aromatics.

## SASSAFRAS RADIX.

*Origin.*—The Sassafras\* officinale, N. O. Lauraceæ, is a diœcious shrub, and is common throughout the United States.

The fresh flowers, which are small, and of a pale yellow colour, have a slightly fragrant odour, and all parts of the plant are more or less aromatic.

The pith of the stems is officinal in the United States Pharmacopœia, as well as the root bark.

*Characters.*—The root and its bark are easily known by their agreeable aromatic taste and odour, especially from a freshly cut or broken surface. These properties reside in a volatile oil (1 or 2%) which is heavier than water, sp. gr. 1.094. It contains a hydrocarbon, *safran* ( $C_{10}H_{16}$ ), an oxidised stearopten or camphor, *sassafröl* ( $C_{10}H_{10}O_2$ ), and an isomer, *safröl*.

*In Medicine.*—A pleasant, fragrant stimulant, at one time

\* *Sassefrass*, an American river, on whose banks it grows in abundance.



held in considerable reputation, but not shown to possess any real efficiency, and it is merely retained from custom in the Dec. Sarsæ Co., the flavour of which it improves.

### SCAMMONIÆ RADIX.

### SCAMMONIÆ RESINA.

### SCAMMONIUM.

*Origin.*—The *Convolvulus Scammonia*, N. O. *Convolvulaceæ*, like its ally *jalap*, is a slender twining plant, bearing yellow or white flowers, with purple or red stripes.\*

It is a native of Syria, Anatolia, and some of the neighbouring islands. No part of the plant is used except the root. Scammony has been known for more than 2000 years, and Aleppo scammony is the most esteemed.

*Characters of the Root.*—The root is known by its large size, hardness, peculiar though slight odour, and by the amount of resin it contains which is easily extracted by ether or alcohol.

*In Pharmacy.*—Employed solely as one source of the resin.

*Preparation of the Resin.*—The process is essentially the same as that followed in the preparation of the other purgative resins, viz. those of *jalap* and *podophyllum*.

(1) Exhaust the dry scammony root, or the gum resin scammony, with warm rectified spirit.

(2) Precipitate the resin by adding water to the tincture thus obtained; distil off the spirit, and dry the residual cake of resin.

\* What is called *French* (Montpellier) *scammony*, is the dried exudation from the rhizome of *Cynanchum monspeliacum*, N. O. *Asclepiadaceæ*. It is of little value, as are also the so called *Bourbon*, *German*, and *American* scammony.

*Characters and Tests of the Resin.*—If prepared from the gum resin, it is of a light brown colour, and retains some of the disagreeable sour odour of scammony, but if obtained from the root, it is in brown, translucent pieces, and possesses a heavy, sweet odour, wholly different from that of scammony. The resin is distinguished from the gum resin scammony, by its incapability of forming singly an emulsion with water, owing to the absence of gum.

The chief ingredient of the resin is a glucoside, *scammonin*, identical with jalapin, and approaching closely in its composition and properties to *convolvulin*, the chief active ingredient of jalap (see Jalapa).

Resin of scammony is liable to various adulterations, e.g. (a) guaiacum resin, detected by the tincture rendering blue the cut surface of a raw potato (see Guaiaci Resina). (b) Jalap resin, which is only partially soluble in ether; and (c) common resin or colophony, with which sulphuric acid strikes at once a deep red colour.

It is stated that the presence of other resins than those of the Convolvulaceæ may be recognised by the formation of a precipitate on adding sulphuric acid to their alkaline solution.

The three purgative resins of podophyllum, jalap, and scammony, are insoluble in benzine.

*In Pharmacy.*—When triturated with new milk, resin of scammony forms a uniform emulsion, exactly like rich milk itself (*Mistura Scammonii*). The Pil. Scamm. Co. contains 1 of the resin in 5.

*Preparation of the Gum Resin.*—The root of the plant is cut off obliquely, and the milky juice which exudes is collected in mussel shells. This forms the finest scammony, which however is very rarely met with. A single root does not generally yield enough to fill one shell. On its way to the market from the peasants who collect it, it undergoes many changes, and is frequently grossly adulterated. All kinds of frauds are practised, and it is difficult to obtain a specimen of genuine

scammony in commerce. As examples of materials added to it, may be mentioned the expressed juice of the stems and leaves, flour, chalk, ashes, sand, gum, resin, &c.

*Characters and Tests of the Gum Resin.*—Scammony is imported in the form of large, irregular lumps, or in circular, flattened cakes. Pure (virgin) scammony is in rough, grey fragments, and may not inaptly be compared to pieces of cinder. The sour odour, like that of old cheese, is very characteristic. Inferior scammony is in dark, tenacious masses, not easily powdered, and contains little resin. The gum resin may be distinguished from the resin of scammony by its capability of forming a turbid emulsion when rubbed up with water. The presence of chalk would be detected by effervescence on the addition of hydrochloric acid; and of starch, by the development of blue colour on the addition of iodine to the cooled decoction. The active ingredient of scammony is its resin, which in very pure specimens amounts to 80 or 90%, but this proportion is seldom met with, and the amount of resin is frequently as low as 50%, and in the worst varieties as little as 10%, or even less. In consequence of this uncertainty, it would be much better to abandon the gum resin, and to employ solely the resin of scammony, which is of uniform strength. The resin is admitted into the Extr. Coloc. Co., the Mist. Scammonii, and Pil. Scammonii Comp., but, inconsistently, is excluded from the other preparations.

*In Pharmacy.*—The preparation of scammony most in demand is the Pil. Coloc. Co., in which, as well as in the Conf. Scammonii, the proportion of scammony is 1 in 3. In the Pulv. Scamm. Co. it is a little greater, viz. 1 in 2.

*In Medicine.*—As an active and efficient cathartic, scammony has been long in use, and is a valuable remedy in the treatment of obstinate constipation. It is rather irritant and apt to gripe, and as seen from its preparations, is usually administered in combination with other purgatives, whose action it materially aids. As with the convolvulin of jalap, the purgative action of

scammony is dependent upon contact of the resin with bile, i. e. an alkaline fluid. The Mist. Scammonii is a good purgative to give in a case of intestinal worms; especially with children, on account of its insipidity and moderate bulk.

## SCILLA.

*Origin.*—The Urginea Scilla,\* N. O. Liliaceæ, is a perennial plant, bearing a large, basal bulb, and a long, close raceme of white flowers on a succulent flower stem.

*Characters.*—The fresh bulb or underground stem is ovoid or pear shaped, and varies considerably in size. It is mainly composed of overlapping, fleshy scales, attached to a conical disc, and a *red* and a *white* variety is distinguished according to the colour of the outer scales. The red (male or Spanish squill) is the most common. Squill is prepared for commerce by cutting it into thin transverse slices (rejecting the inert central and the dry outermost scales), and drying these carefully. The bulb loses about  $\frac{2}{3}$  of its weight in the process. The dried fragments are easily known by their irregularly curved form, yellowish white colour, and nauseous, bitter taste. They are very hygroscopic, and can be powdered only when perfectly dry. Under the microscope, numerous minute acicular crystals, chiefly of carbonate and oxalate of lime, are seen.

The chemistry of squill is not satisfactorily made out, notwithstanding numerous attempts to solve it. It contains a good deal of mucilage, sugar, and tannin, and a small quantity of a crystalline principle, *scillitin*, which possesses energetic narcotico-acrid properties. The aqueous infusion is rendered deep purple by persalts of iron.

*In Pharmacy.*—The Acetum and Tinct. Scillæ are of the same

\* Σκίλλω, to dry; because it was believed to dry up the humours.

strength, viz. 1 in 8; the Pil. Scillæ Co. contains a little more squill than the Pil. Ipecac. c. Scilla, and is more stimulant in its action.

*In Medicine.*—In overdoses squill is capable of causing death as an irritant purgative, and may also induce strangury and bloody urine. In medicinal doses it is chiefly used for three purposes, viz. as an expectorant, diuretic, and emetic, principally for the two former. In bronchitis, attended with difficulty of expectoration, it is frequently prescribed with benefit, especially when conjoined with ipecacuanha, as in Pil. Ipecac. c. Scilla. In infantile catarrhal complaints it is a favourite remedy, and is occasionally used as a diuretic in cases of dropsy; combined with blue pill and digitalis it constitutes Baly's pill, a formula frequently used in some forms of cardiac and hepatic dropsy.

For children, the Oxymel and Syrup of Squill are generally preferred, and for adults, either of the two officinal pills furnishes a suitable form for administration.

## SCOPARII CACUMINA.

*Origin.*—Broom, *Sarothamnus Scoparius*, \* N.O. Leguminosæ, is a common indigenous shrub, with numerous straight, pentangular, very flexible branches, and small oblong leaves, usually ternate. The flowers are borne in showy racemes, are golden yellow in colour, and papilionaceous in form. The seeds are contained in a flattened pod.

*Characters.*—The sharp angles on the twigs and their disagreeable odour and taste distinguish them from all other flowering tops. According to Dr. Stenhouse, the diuretic properties of broom reside in a crystalline principle termed *scoparin*

\* *Scopæ*, a broom.

$C_{21}H_{22}O_{10}$ , while a volatile alkaloid, of narcotic powers, termed *sparteia* ( $C_{15}H_{26}N_2$ ) can be separated by distillation.

*In Medicine.*—Broom possesses the properties of a mild, non-stimulating diuretic, and as such has been long in use in the treatment of dropsical complaints.

It sometimes acts as a cathartic or emetic.

Hitherto the Decoction has been the preparation generally employed, but the Succus, i. e. fresh expressed juice, recently introduced, offers a more reliable form for administration.

### SENEGÆ RADIX.

*Origin.*—The Senega (or Seneka\*) snake root, Polygalaf Senega, N. O. Polygalaceæ, is a common plant in the U.S., and the root is brought to the market in large bales.

*Characters.*—The drug is at once known from other roots (e. g. Panax and Gillenia) by its contorted, knotted form, and especially by the sharp ridge or keel which extends along its whole length. The active principles reside exclusively in the bark, which is hard and yellowish, and the taste is peculiar, acrid and pungent. The pungency seems to belong to the glucoside, termed *saponin* (senegin),  $C_{32}H_{54}O_{18}$ .

*In Medicine.*—Senega is chiefly employed as a stimulating expectorant in cases of chronic bronchitis and obstinate catarrh. In large doses it is emetic and cathartic. It is quite useless as an antidote to snake poison.  $\mathfrak{z}$ i. of the Infusion, or  $\mathfrak{z}$ ss. of the Tincture, may be given.

\* The name of an Indian tribe, who employ the plant as an antidote to snake poison. (Dorvault.)

† Πολύε, γάλα; from its abundant milky juice.



## SENNA\* ALEXANDRINA.

## SENNA INDICA.

*Origin.*—Senna consists of the *leaflets* of several species of the genus *Cassia*, N. O. Leguminosæ, one species of which has been already met with, viz. *C. fistula* (see *Cassia*). The senna yielding plants were formerly massed by Linnæus under a single species, but it is now known that at least three species, and probably more, contribute to furnish the senna of commerce. The senna plants are small undershrubs, with yellow flowers, and bear alternate, pinnate leaves, with from four to eight pairs of leaflets along the common leaf stalk. The varieties of senna are founded on the form of these leaflets. Alexandrian† senna is frequently mixed with various impurities and adulterations, e.g., the pods, broken leafstalks, flowers, and fragments of other parts of the *Cassia*, and the leaves of argel (*Solenostemma Argel*, N. O. *Asclepiadacæ*), and other plants. Commercial senna is prepared for use by picking out the leaflets and rejecting everything else. The legumes and stalks are purgative, but in a less degree than the leaflets.

*Characters and Tests.*—The general characters of senna leaflets are, their light green colour, distinct veins, thin texture, smooth surface with entire edges, and an oblique base, i. e. one side of the leaflet inserted into the stalk a little lower than the other, and at a different angle. Attention to these points will readily distinguish true senna from the irritant argel leaves or other adulterations. The most dangerous admixture is the leaves of *Coriaria myrtifolia*, which are very astringent and poisonous. The special characters of the leaflets of the three officinal species are briefly these :—

\* Arabic, *Senna*, acute ; from its pointed leaves.

† So named from the port whence it is shipped.

C. LANCEOLATA.	C. OBOVATA.	C. ELONGATA.
Furnishes the greater part of Alexandrian senna. A native of the upper parts of Africa.	Contributes to Alexandrian senna. Yields Aleppo senna. A native of Syria and of Egypt.	Yields Indian senna. Shaped like a pike fish. A native of Arabia.

The Tinnivelly or E. Indian senna is a very fine green variety, being free from stalks, legumes, or any adulteration. In a damp atmosphere the leaflets are apt to become yellow, or even black.

The most important constituent of senna, and the one upon which its purgative property probably depends, is *cathartic acid*, a peculiar sulphuretted glucoside. The free acid is insoluble in water, strong alcohol, and ether, but is readily soluble when combined with alkaline and earthy bases, in which form it exists in senna. Alkalies aided by heat act destructively upon it. It purges actively in doses of 1 or 2 grs.

*In Pharmacy.*—The virtues of senna are extracted by water (Infusum), and spirit (Tinctura). The infusion throws down a yellowish precipitate on exposure to the air, and is incompatible with many substances. “It is here satisfactory to observe that the cathartate of magnesia is soluble, and that the old fashioned *black draught* (Mist. Sennæ Co.) agrees with new fashioned science” (Groves). Senna enters into the new Pulv. Glycyrrh. Co.

*In Medicine.*—Senna has been in use for centuries as a prompt, efficient, and safe purgative. It acts chiefly upon the small intestines, and is apt to produce unpleasant griping, owing to the intensity of the peristaltic contractions. This may be obviated by combining it with some aromatic, especially coriander, and adding some of the milder purgative salts, such as sulphate of magnesium, or one of the tartrates of potassium. The stools which

senna produces are feculent and not serous. Its purgative effect is believed to be increased by combination with bitters.

Senna communicates a dark colour to the urine, which is intensified by the subsequent addition of ammonia. The infusion when injected into the veins operates as a cathartic, and it is said that senna when taken by nurses will purge suckling infants. The Syrupus Sennæ is by far the most agreeable preparation to take, in doses of from ʒi. to ʒij., but all the other preparations are in common use.

### SERPENTARIÆ RADIX.

*Origin.*—Virginian Snakeroot consists of the rhizome and rootlets of Aristolochia (*Ἀριστοσ*, best, *λοχεία*, the lochia; because used for promoting that discharge) *Serpentaria*,\* N.O. Aristolochiaceæ, a herbaceous plant common in the middle, southern, and western States of America. Under the above name several different plants have been confounded by botanists (Guibourt).

*Characters.*—Distinguished by its long, slender tufts of brittle root fibres, attached to a short, knotty stock. It bears some resemblance to Valerian root, which however is characterised by its nauseous odour.

*In Medicine.*—Serpentary is an aromatic and stimulant tonic, and has been especially recommended in fevers, but is seldom prescribed now.

It is quite valueless as an antidote to snake poison. In large doses it causes nausea, purging, headache, and cerebral oppression, operating similarly to camphor.

\* The name *Serpentary* is also applied to *Arum dracuncul*us.

## SEVUM \* PRÆPARATUM.

*Origin.*—Suet is the fat of the sheep, *Ovis Aries*. It is taken chiefly from about the kidneys, and is prepared by melting it and straining through linen or flannel.

*Characters.*—Suet is the hardest of the animal fats, and requires a higher temperature to melt it. In time it is liable to become rancid, and therefore unfit for pharmaceutic purposes. It is almost exclusively composed of stearin ( $C_3H_5'''$ ,  $3C_{18}H_{35}O_2$ ).

*In Pharmacy.*—Employed solely to give proper consistence to some ointments and plasters.

## SINAPIS.

*Origin.*—Ordinary *flour of mustard*, or *table mustard*, consists of the mixed powder of the seeds of black and white mustard, *Sinapis alba* and *S. nigra*, N.O. *Cruciferae*. The powder of the black seeds alone would be much too pungent for use at table. Both plants are annuals, and natives of Europe; the flowers are yellow, and the seeds occur in commerce both whole and in the state of very fine powder.

*Characters of the Seeds.*—*Black* mustard seeds are small, globular, of a deep brown colour, slightly wrinkled on the surface, and internally yellow. *White* mustard seeds are twice as large, about the size of colchicum seeds, of a yellow colour externally and internally, and have a less pungent taste than the black. Both kinds of seed yield upon pressure a pale yellow *fixed* oil, sp. gr. 0.915, with little smell and taste, and which is not to be confounded with the acrid volatile oil, i.e. the officinal *Oleum Sinapis*. The fixed oil contains the glycerides of erucic, stearic, and oleic acids.

*Characters of the Powder.*—The odour and taste of moistened mustard powder are universally familiar, and it has been long

\* As if *Su-rum*; from *Sus*, a hog.

known that the dry seeds or powder possess little or no odour, and that the black mustard seeds alone, on distillation, yield a very irritating volatile oil. This volatile oil does not pre-exist in the seed (as first shown by Guibourt), but as in the analogous cases of bitter almonds and cherry laurel (see *Amygdala* and *Aqua Laurocerasi*), is produced by a peculiar fermentation, in the following way. Both seeds contain an albuminous principle, termed myrosin (analogous to but distinct from the emulsin of almonds); the black mustard alone contains the remarkable glucoside acid, called myronic acid, in union with potassium. The volatile oil is developed by the decomposition of this myronate of potassium under the influence of the myrosin, in the *presence of water*.— $\text{K C}_{10}\text{H}_{18}\text{N S}_2\text{O}_{10} = \text{KHSO}_4 + \text{C}_6\text{H}_{12}\text{O}_6 + \text{C}_3\text{H}_5, \text{CNS}$ .  
glucose.                      volatile oil.

Hence, it appears that essential oil of mustard consists of sulphocyanate of the radical allyl ( $\text{C}_3\text{H}_5$ ).

Although white mustard seeds are destitute of myronic acid, and therefore cannot furnish this volatile oil, they contain a glucoside principle, termed *sinalbin* ( $\text{C}_{30} \text{H}_{44}\text{N}_2\text{S}_2\text{O}_{16}$ ), which in contact with myrosin, in the presence of water, yields sugar, sulphocyanate of acrinyl,  $\text{C}_7\text{H}_7\text{O}, \text{CNS}$ , and sulphate of an alkaloid, *sinapin*. This alkaloid, sinapin,  $\text{C}_{16}\text{H}_{23}\text{NO}_5$ , also exists normally in black and white mustard seed as a sulphocyanate, and in this form has received a perplexing number of names from different chemists (sulpho-sinapisin, sinapin of Berzelius, sinapisin, &c.). Owing to the presence of this sulphocyanate, an infusion of mustard seeds strikes a deep red colour with ferric chloride. To these various compounds white mustard owes its acidity. The same agents which destroy the activity of emulsin, viz. boiling water, alcohol, and acids, also neutralise the efficiency of myrosin as a ferment, and the best vehicle for mustard, whether for external or internal use, is water at common temperatures. The characters and constituents of the

two varieties of mustard seed are contrasted in the following table :—

BLACK.	WHITE.
Small; dark brown.	Larger; yellow.
Taste hot and pungent.	Taste less pungent.
Contains fixed oil.	Contains fixed oil.
Contains myrosin and myronic acid.	Contains myrosin.
Hence yields "Oleum Sinapis" (0·5 to 1%) on distillation.	Does not yield volatile oil.
Contains sulphocyanate of sinapin.	Contains sulphocyanate of sinapin.

The mustard of commerce is commonly adulterated with starch or flour, coloured yellow by turmeric, and rendered pungent by capsicum.

*In Pharmacy.*—For the reasons stated above, Catapl. Sinapis should *not* be prepared with boiling water. From black mustard seeds is prepared the Charta Sinapis.

*In Medicine.*—Mustard is very frequently used externally as a poultice or sinapism, to relieve pain, and to act as a stimulant and counter-irritant. In this form it soon produces redness, with burning pain, and, on a tender skin, will vesicate. If too long applied to young children, or to patients in an insensible condition, troublesome ulcerations, and even gangrene leading to fatal results have followed. Instead of a mustard poultice, the new Charta Sinapis, a substitute for Rigollot's "mustard papers" may be used, and Lebaigue proposes as a substitute a "sinapism tissue," prepared as follows: One piece of paper or fine muslin, is moistened with a solution of myrosin, and another with solution of myronate of potassium. When dried and required for use, they are applied to the skin, one over the other, and are then moistened with water.

"Sinapine paper" owes its efficacy chiefly to capsicum. Internally, mustard is chiefly used as a stimulating emetic whenever a rapid evacuation of the stomach is desirable. A teaspoonful or a tablespoonful of the powder may be given for a dose.



The Oleum Sinapis, a violent irritant, may be used externally, six to eight minims in  $\text{ʒi.}$  of almond or olive oil, and it has been occasionally prescribed internally in the dose of  $\frac{1}{6}$  minim. It is said to impart the smell of horseradish to the urine.

## *SODIUM.*

$\text{Na} = 23.$

### *TABLE OF THE COMPOUNDS AND PREPARATIONS OF SODIUM IN THE PHARMACOPŒIA.*

#### CLASS I.—OXIDE.

- |                          |   |
|--------------------------|---|
| 1. Soda Caustica.        | $\text{NaHO.}$                                      |
| Liq. Sodæ.               | 18·80 grs. $\text{NaHO}$ in $\text{ʒi.}$            |
| Volum. solution of soda. | 40 grs. $\text{NaHO}$ in 1000 grs. meas., App. III. |

#### CLASS II.—NON-OXYGENATED (HALOID) SALT.

- |                     |                |
|---------------------|----------------|
| 2. Sodii Chloridum. | $\text{NaCl.}$ |
|---------------------|----------------|

#### CLASS III.—OXY-SALTS.

- |                     |   |
|---------------------|---|
| 3. Soda Tartarata.  | $\text{NaKC}_4\text{H}_4\text{O}_6, 4\text{H}_2\text{O. (NaK}\overline{\text{T}}.)$ |
| 4. Sodæ Acetas.     | $\text{NaC}_2\text{H}_3\text{O}_2, 3\text{H}_2\text{O. (NaA}\overline{.})$          |
| Solution of,        | App. II.  |
| 5. Sodæ Arsenias.   | $\text{Na}_2\text{HASO}_4, 7\text{H}_2\text{O.}$                                    |
| Liq. Sodæ Arsen.    | 4 grs. (dried) in $\text{ʒi.}$  |
| 6. Sodæ Bicarbonas. | $\text{NaHCO}_3.$   |
| Liq. Sodæ Efferv.   | 30 grs. $\text{NaHCO}_3$ in Oi.   |
| Troch. Sodæ Bicarb. | 5 grs. in each.   |
| 7. Sodæ Boras.      | $\text{Na}_2\text{B}_4\text{O}_7, 10\text{H}_2\text{O.}$                            |
| Glycer. Boracis.    | 1 in 6 by weight.   |
| Mel Boracis.        | 56 grs. in $\text{ʒi.}$   |

8. Sodæ Carbonas.	$\text{Na}_2\text{CO}_3, 10\text{H}_2\text{O}.$
9. Sodæ Carbonas Exsicc.	$\text{Na}_2\text{CO}_3.$
10. Sodæ Chlor. Liq.	$\text{NaCl}, \text{NaClO}(\text{Na}_2\text{OCl}_2).$
Catapl. Sodæ Chlor.	
11. Sodæ Citro-Tart. Efferv.	
12. Sodæ Hypophosphis.	$\text{NaPH}_2\text{O}_2.$
13. Sodæ Hyposulphis.	$\text{Na}_2\text{S}_2\text{H}_2\text{O}_4, 4\text{H}_2\text{O}.$ App. I.
Volumetric solution of,	App. III.
14. Sodæ Nitras.	$\text{NaNO}_3.$
15. Sodæ Phosphas.	$\text{Na}_2\text{HPO}_4, 12\text{H}_2\text{O}.$
Solution of,	App. II.
16. Sodæ Sulphas.	$\text{Na}_2\text{SO}_4, 10\text{H}_2\text{O}.$
17. Sodæ Valerianas.	$\text{NaC}_5\text{H}_9\text{O}_2(\text{Na}\bar{\text{V}}).$

All the officinal soda salts are colourless.

*Origin.*—Sodium, the radical of the soda compounds, is prepared by a process similar to that for potassium, and like it, is a soft, silver white metal, lighter than water (sp. gr. 0.97), and with an eager affinity for oxygen.

It was first isolated by Davy in 1807. The primary source of the sodium compounds is common salt,  $\text{NaCl}$  (sea or bay salt, rock salt). From this natural product carbonate of sodium is prepared by Leblanc's process, and from this all the other sodium compounds are directly or indirectly obtained. Nitrate of sodium also occurs in nature as an efflorescence on the soil of certain districts, e. g. South America, but this salt is chiefly valuable as a source of nitric acid (see *Ac. Nitricum*), and as an oxidising agent in chemistry (see *Sodæ Arsenias*).

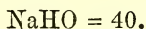
In the vegetable kingdom much of the carbonate of sodium of commerce was formerly derived from Spanish *barilla* (i. e. the ashes of flowering plants growing near the sea), and some from *kelp* (i. e. the ashes of cryptogamous plants, algæ, &c., growing in the sea), but these natural sources of the alkali are now superseded by Leblanc's artificial process.

*Chemical relations.*—Sodium is a monad, or univalent radical, Na, and hence the formula of its chloride is NaCl, nitrate  $\text{NaNO}_3$ , and so on. It belongs to the class of alkaline metals (K, Na, L, &  $\text{NH}_4$ ), and in all its chemical properties is closely analogous to potassium, so that in many experiments it is a matter of indifference whether a sodium or a potassium salt be employed. But sodium salts are clearly distinguished from potassium salts by not affording precipitates with  $\text{PtCl}_4$  or tartaric acid (see Potassium), and in fact, since sodium is the only metal whose ordinary salts are all soluble in water, there is no good precipitation test for this metal.

The principal and most reliable analytical reaction for sodium is the *flame test*, i. e. the communication of an intensely yellow colour to a clear flame. So delicate is this test, and so universally diffused are the compounds of sodium, that it is difficult to obtain a flame perfectly free from all traces of sodium colouration.

*General Therapeutical Effects.*—These are so similar to those of the preparations of potassium that it will be sufficient to refer to the remarks made under that head (see Potassium). When absorbed, the salts of soda, e. g. the bicarbonate, act like alkalies in general; i. e. they favour the combinations of combustible matters with oxygen, and set going in the system the different changes which evidence an increase in the activity of the respiratory process of oxidation, viz. augmentation of urea, increased metamorphosis of tissue, and ultimately, diminution of the red corpuscles, an aplastic condition of the blood, and a scorbutic cachexia, with diffused hemorrhages, and anasarca.

## SODA CAUSTICA.



The term *caustic soda* is frequently applied both to the solid

hydrate and to its solution in water, Liq. Sodæ, which has already been described (p. 426).

*Preparation.*—Evaporate the solution (Liq. Sodæ) to dryness in a silver or clean iron vessel as rapidly as possible, to prevent absorption of carbonic acid gas. It is usually allowed to solidify in mass, and is then broken up into irregular fragments, but is sometimes cast into cylindrical moulds. Neither platinum, glass, nor porcelain vessels are admissible in its preparation, because the caustic alkali would act chemically on these materials, and the product is kept in *green* glass bottles, because they resist the action of the alkali better than those made of white glass, which contain oxide of lead. Very pure sodic hydrate, prepared by decomposing water by metallic sodium, can now be had at a moderate price. The common “soda” of commerce is carbonate of sodium.

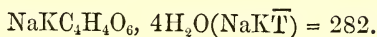
*Characters and Tests.*—The general characters of caustic soda are so similar to those of caustic potash, that it is sufficient here to mention that it does not exhibit such an affinity for water as potash, while its carbonate instead of being deliquescent is efflorescent. Accordingly, caustic potash, when exposed to the air, absorbs  $H_2O$  and  $CO_2$ , and becomes permanently liquid, while caustic soda similarly treated forms a paste, which after a time effloresces.

It is apt to contain impurities, viz. chlorides and sulphates, derived from the carbonate of sodium used in preparing the original solution, and these are tested for respectively by nitrate of silver and chloride of barium, each of which would give a white precipitate in the acidulated solution. The precise alkaline value of the caustic soda is ascertained by neutralisation with standard oxalic acid. If perfectly pure, 40 grs. of soda,  $NaHO$  (1 molecule), should exactly neutralise 1000 gr. measures of the volumetric solution of oxalic acid (i. e.  $\frac{1}{2}$  a molecule of the dibasic acid).

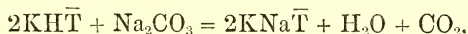
*In Medicine.*—It may be used externally as a caustic in the

same manner as potash. For that purpose it is best melted and cast into sticks.

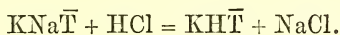
### SODA TARTARATA.



*Preparation.*—This compound, commonly called *Rochelle salt*,\* is, like all the tartrates, prepared from the acid tartrate of potassium. Add cream of tartar to a hot strong solution of carbonate of sodium so long as effervescence of carbonic acid gas occurs. Boil, filter, and crystallise—



*Characters and Tests.*—The crystals of Rochelle salt usually occur as halves of large, colourless, right rhombic prisms, which have been likened to tomb stones, and they appear as if split in the direction of their longer axis. It is very soluble in water, and possesses a saline and slightly bitter taste. Any insoluble residue is impurity, probably tartrate of calcium or acid tartrate of potassium. When heated, especially along with sulphuric acid, the tartaric acid is destroyed, the mass is charred, and a residue of mixed carbonates of potassium and sodium is left. Owing to the insolubility of acid tartrate of potassium, any soluble acid, e. g. HCl, will cause a crystalline precipitate in a strong solution of this salt—



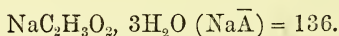
If pure, 141 grs. (i. e. half a molecule), reduced by heat to the state of carbonate, will require for neutralisation 1000 gr. measures of the volumetric solution of oxalic acid (i. e. half a molecule).

\* Discovered by Seignette, an apothecary of Rochelle. It is sometimes termed *Seignette's salt*.

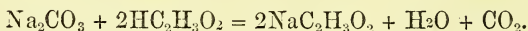
*In Medicine.*—A mild and cooling hydragogue purgative, acceptable to the stomach, and one of the least unpalatable of the purgative salts.

It may be advantageously combined with senna, but is in familiar use as an ingredient in the effervescing aperient known as *Seidlitz powders*. The usual composition of these is:—In the *blue* paper packet is a mixture of 120 grs. of Rochelle salt, with 40 grs. of bicarbonate of sodium; and in the *white* paper packet, are 40 grs. of tartaric acid. The acid would bleach the colour of the blue paper. When the alkaline powder is added to the acid powder in solution, brisk effervescence occurs, and the salts in the solution are three in number, viz. Rochelle salt, neutral tartrate of sodium ( $\text{Na}_2\bar{\text{T}}$ ), and acid tartrate of sodium ( $\text{NaHT}$ ). A full dose of Rochelle salt is  $\bar{\text{z}}$ i. It is eliminated in the urine as alkaline carbonate.

### SODÆ ACETAS.



*Preparation.*—Add carbonate of sodium to acetic acid until effervescence ceases, and evaporate the resulting solution—



*Characters and Tests.*—A slowly efflorescent salt, occurring in long striated prisms, and possessing a sharp, bitter taste. Charred by heat, and converted into carbonate of sodium. The absence of sulphates or chlorides as impurities is shown by chloride of barium and nitrate of silver not precipitating the dilute solution. A strong solution of the pure salt would give with nitrate of silver a crystalline precipitate of acetate of silver, which dissolves on the addition of more water.

*In Pharmacy.*—Used in the preparation of two of the tribasic salts of iron, the phosphate and arseniate. It affords a ready

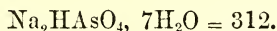


source of acetic acid when treated with sulphuric acid, and from it acetic ether also may be prepared. A 10% solution in distilled water forms the Solution of Acetate of Soda, App. II., used as a test.

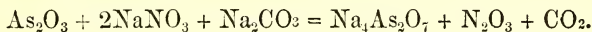
*In Medicine.*—A mild diuretic and cathartic, with the same medicinal properties as acetate of potassium, over which it has the advantage of not being deliquescent.

Dose, 20 to 100 grs.

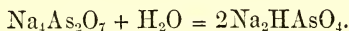
### SODÆ ARSENIAS.



*Preparation.*—Fuse well together a mixture of white arsenic ( $\text{As}_2\text{O}_3$ ), nitrate of sodium, and dried carbonate of sodium, until all effervescence ceases. Dissolve the fused product in boiling water, set aside to crystallise, and dry. On fusion, pyro-arsenate of sodium ( $\text{Na}_4\text{As}_2\text{O}_7$ ) is produced—

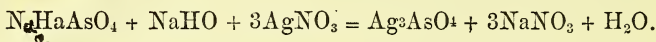


By solution of the pyro-arsenate in water, the officinal arseniate is formed—



*Characters and Tests.*—The formula of the fresh crystals is  $\text{Na}_2\text{HAsO}_4, 12\text{H}_2\text{O}$  ( $= 53.7\% \text{H}_2\text{O}$ ), but they soon effloresce and yield the more stable salt represented by  $\text{Na}_2\text{HAsO}_4, 7\text{H}_2\text{O}$  ( $= 40.4\% \text{H}_2\text{O}$ ). Hence the officinal salt when heated to  $300^\circ \text{F.}$ , so as to drive off all its water of crystallisation, loses  $\frac{2}{5}$  of its weight. Since the proportion of water of crystallisation is thus liable to vary, it is better to use the dried salt in the preparation of Liq. Sodæ Arseniatis in order to secure constancy in the strength of an active preparation. Arseniate of sodium is readily soluble in water, all non-alkaline neutral arseniates are insoluble.

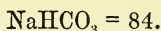
The most characteristic test for a soluble arseniate consists in the formation with argentic nitrate of a brick red precipitate ( $\text{Ag}_3\text{AsO}_4$ ), soluble in dilute acids. The purity of the salt is ascertained by precipitating completely a known weight of the dried arseniate with standard solution of nitrate of silver, a little caustic soda being first added so as to prevent the liberation of any nitric acid which would redissolve some of the precipitate—



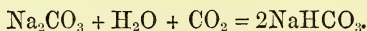
*In Medicine.*—It possesses the general properties of the arsenical compounds, and may be employed for the same purposes (see *Acidum Arseniosum*).

The average dose is about  $\frac{1}{12}$  gr., i. e. 10 m. of the officinal solution. Pearson's arsenical solution contained only 1 gr. of the sodic arseniate in  $\text{℥i}$ .

### SODÆ BICARBONAS.



*Preparation.*—Pass a stream of carbonic acid gas over a mixture of two parts of the crystallised and three parts of the dried carbonate of sodium until the gas ceases to be absorbed—



The crystallised carbonate contains  $10\text{H}_2\text{O}$  of crystallisation, while the bicarbonate is anhydrous; consequently a considerable quantity of water is liberated, and the resulting product becomes damp. If part of the original carbonate were not first rendered anhydrous by heat, the mass would gradually become too moist and even semi-fluid. To purify the resulting bicarbonate from the more soluble carbonate or other salts, agitate it with half its weight of cold water, drain the undissolved portion, and dry it slowly by exposure to the air.

*Characters and Tests.*—Distinguished from the carbonate by its occurrence in small, snow white grains or scales, which are permanent in the air, and are caustic to the taste. It is much less soluble than the carbonate, and requires thirteen parts of cold water for solution. From potassic bicarbonate it is distinguished by  $\text{PtCl}_4$  not precipitating its  $\text{HCl}$  solution, while it is chemically separated from its own carbonate by affording a faint white, and not a coloured precipitate (oxychloride), with corrosive sublimate, and by not precipitating sulphate of magnesium in the cold. But even good commercial bicarbonate is liable to contain 2 or 3% of the carbonate. The absence of sulphates and chlorides is shown by chloride of barium and nitrate of silver respectively giving no precipitate in its nitric acid solution. When heated, it gradually parts with its carbonic acid, and at a red heat loses it all (viz. 37%), and is reduced to the neutral anhydrous carbonate ( $\text{Na}_2\text{CO}_3$ ). Hence, 84 grs. of the  $\text{NaHCO}_3$  (i. e. 1 molecule, = 1 atom Na) will produce 53 grs. of  $\text{Na}_2\text{CO}_3$  (i. e.  $\frac{1}{2}$  a molecule), and will therefore neutralise 1000 gr. measures of the volumetric solution of oxalic acid (i. e.  $\frac{1}{2}$  a molecule).

*In Medicine.*—A mild, unirritating antacid and sedative, frequently prescribed for the general purposes to which alkalies are applied, and it is largely consumed in the preparation of soda water (Liq. Sodæ Efferv.); soda powders (Sodæ Citro-Tart. Efferv.); seidlitz powders, and other effervescing mixtures.

In prescribing effervescing mixtures, it may be said, in round numbers, that 20 grs. of citric, or 22 grs. of tartaric acid, will saturate 29 grs. of  $\text{KHCO}_3$ , and 24 grs. of  $\text{NaHCO}_3$ ; or as the Pharmacopœia states it, 20 grs. of  $\text{NaHCO}_3$  will neutralise 17 grs. of citric acid and 18 grs. of tartaric acid. It is also useful to remember that lemon juice contains, on an average, 7% of citric acid, i. e. 32 grs. in  $\text{℥i.}$ , or 4 grs. in  $\text{℥i.}$

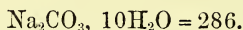
In full doses it renders the urine alkaline.

The Vichy waters, so much in favour for gouty and dyspeptic complaints, contain bicarbonate of sodium.

### SODÆ BORAS.

See Borax, p. 163.

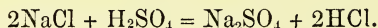
### SODÆ CARBONAS.



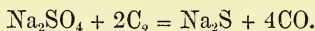
*Origin and Preparation.*—Carbonate of sodium was, as has been seen, formerly extracted from the ashes of vegetables (see Sodium), but it is now obtained from common salt by the salt cake process, discovered by Leblanc in 1784.

The essential steps are two :—

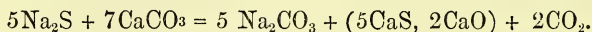
1. The chloride of sodium is converted into sulphate (salt cake) by sulphuric acid.—



2. The salt cake is then heated with an excess of limestone ( $\text{CaCO}_3$ ), and small coal or charcoal, and the resulting black mass is termed *black ash*, or *British barilla*. The carbon reduces the sulphate to sulphide of sodium—



The sulphide reacts on the limestone and produces an insoluble oxy-sulphide of calcium, and carbonate of sodium—



The crude carbonate is dissolved out by water and heated with sawdust, which, by the carbonic acid formed in its combustion, converts into carbonate any caustic soda that may have been produced by the action of quicklime on the sodic carbonate.

The carbonate of sodium or *soda ash*, dissolved in water and crystallised, constitutes the ordinary *washing soda*, and when recrystallised it forms the officinal carbonate.

Of late years, much carbonate of soda is made by what is called the “ammonia process.” The principle of this is, that when bicarbonate of ammonium is made to act upon a strong solution of common salt, the greater part of the sodium is precipitated as bicarbonate, while chloride of ammonium remains in solution, from which the ammonia for a second operation is expelled by quicklime. The carbonic acid necessary to convert the ammonia into bicarbonate of ammonia, and thus to make the process a continuous one, is obtained by heating the bicarbonate of soda, so as to convert it into the normal carbonate.

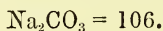
*Characters and Tests.*—Like the other sodium compounds, the carbonate bears a close analogy to the corresponding potassium salt, but besides the chemical tests (see Potassium and Sodium), they are readily distinguished physically. For potassic carbonate eagerly absorbs moisture, becomes damp, and finally liquid, i. e. it is *deliquescent*; while sodic carbonate, on the other hand, gradually yields up some of its abundant water of crystallisation, and becomes opaque and powdery, i. e. it is *efflorescent*. Its solution gives a reddish brown precipitate with corrosive sublimate, and a white precipitate with sulphate of magnesium. It is insoluble in alcohol. The sodic carbonate contains 63% of water of crystallisation, which it completely loses at a sufficient heat. Sulphates and chlorides are tested for as usual by chloride of barium and nitrate of silver, in nitric acid solution. The alkaline value of the salt is ascertained by neutralising a known weight of it with the standard solution of oxalic acid. If quite pure, 143 grs. of the carbonate (i. e.  $\frac{1}{2}$  a molecule) should require exactly 1000 gr. measures of the oxalic acid solution (i. e.  $\frac{1}{2}$  a molecule).

*In Pharmacy.*—From carbonate of sodium all the other salts of sodium are artificially prepared, viz. arseniate, hypophosphite,

phosphate, &c. It is frequently used as a precipitant for insoluble oxides (Antimonii Oxidum), and for insoluble carbonates (Calc. Carb. Præcip., Magnes. Carb., and Zinci Carbonas).

*In Medicine.*—It possesses the antacid properties of an alkali in a high degree, and in an overdose, or in a strong solution, it will act as a caustic, and may even cause death, but is less corrosive than carbonate of potassium. The proper antidote is a weak acid, such as lemon juice or vinegar. In some papular and scaly skin diseases it is used with advantage externally, is efficacious in removing scabs and crusts, and in saponifying greasy or sebaceous accumulations. For a lotion, dissolve 3ij. or 3iij. in Oi. of water; for a bath, from ʒviij. to ʒxvi. of the salt may be used. In consequence of its efflorescence the amount of its water of crystallisation is liable to vary, and hence, as the dose cannot be indicated with precision, it is better, for internal use, to prescribe it in the next form.

### SODÆ CARBONAS EXSICCATA.



*Preparation.*—Heat strongly the crystallised carbonate, grind it to powder, and enclose in a stoppered bottle. On heating the crystals, the salt first melts in the liberated water of crystallisation (aqueous fusion), then becomes dry, and leaves a white porous mass, i. e. anhydrous carbonate of sodium.

*Characters.*—Dried sodic carbonate is a white powder, and differs in nothing from the crystallised salt, save in being devoid of water of crystallisation. If it be dissolved in water the crystals may be reproduced.

*In Medicine.*—The advantages of this preparation are, that it is uniform in strength, is permanent in the air, and admits of being made into pills. One gr. of the dried carbonate = about  $2\frac{1}{2}$  grs. of the crystallised salt.



## SODÆ CHLORATÆ LIQUOR.

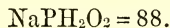
See Liquor Sodæ Chloratæ, p. 427.

## SODÆ CITRO-TARTRAS EFFERVESCENS.

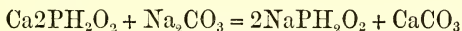
A mechanical mixture of seventeen parts of bicarbonate of sodium with eight parts of tartaric acid, and six parts of citric acid, is heated until the particles become granular. Some carbonic anhydride is expelled by the heat, but the greater part of the carbonate remains undecomposed. When a dose of the mixture is dissolved in water, effervescence from escape of carbonic acid gas occurs, and a mixture of citrate and tartrate of sodium is formed. It is a refrigerant and mild laxative preparation, acceptable to the stomach.

It is similar in composition to the favourite preparation commonly sold under the misnomer of “granular effervescent citrate of magnesia.”

## SODÆ HYPOPHOSPHIS.



*Preparation.*—Add carbonate of sodium to solution of hypophosphite of calcium—



Filter from the precipitated carbonate of calcium, and evaporate the solution.

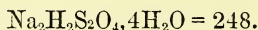
*Characters and Tests.*—A white, crystalline salt. It differs from calcic hypophosphite in being deliquescent, and being readily soluble in spirit as well as in water.

*In Pharmacy.*—Care is requisite in dispensing this salt, owing to the facility with which it is decomposed. An apothecary received the following prescription to compound: Chlorate of potassium, 8 parts; Hypophosphite of sodium, 4; Syrup, 62; Water, 125 parts. In order to expedite matters, he vigorously

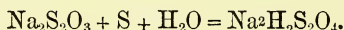
trituated the salts in a mortar, and the result was that the pestle was suddenly forced out of his hand, and he received several injuries. .

*In Medicine.*—Its uses are similar to those of Calcis Hypophosphis, see p. 178.

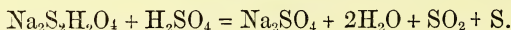
### SODÆ HYPOSULPHIS. App. I.



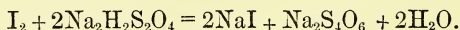
*Preparation.*—May be obtained by gently warming solution of sulphite of sodium with finely powdered sulphur—



*Characters and Tests.*—Occurs in colourless crystals, with a mild saline taste, and freely soluble in water. One of its most remarkable properties is, its power of dissolving insoluble silver salts, especially AgCl, with which it forms an intensely sweet solution; hence its use in photographic operations. Its solution is easily distinguished from that of sulphite of sodium by the precipitation of sulphur on the addition of a few drops of sulphuric acid—



It has no action on iodide of potassium, but exercises a remarkable action on iodine, the red colour of which, in solution, it immediately discharges—



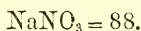
Iodide and tetrathionate of sodium, two colourless salts, are formed.

*In Pharmacy.*—The only application of sodic hyposulphite in the Pharmacopœia, viz., in the quantitative estimation of free iodine volumetrically, is based upon the reaction just given. The details of this process will be explained under Volumetric Analysis, App. III.

*In Medicine.*—Although not admitted as a drug into our Phar-

macopœia, the hyposulphite has been frequently recommended both externally and internally. In consequence of its efficiency in destroying low forms of organic life, it is sometimes prescribed in yeasty vomiting accompanied with *sarcinæ ventriculi*, and externally as a lotion in parasitic skin diseases, especially *tinea versicolor*.

### SODÆ NITRAS.



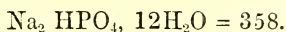
*Origin.*—Large beds or incrustations of this salt are found in Peru, Chili, and other districts of South America, and it is sometimes known as Peruvian or Chilian nitre, or incorrectly, cubic nitre.

*Characters and Tests.*—It is distinguished in form from common nitre (Pot. Nitr.) by crystallising in obtuse rhomboids (incorrectly termed cubes), and not in long, six-sided prisms. Further, it gives rise to an orange or yellow flame when thrown on burning coals. Proved to be a nitrate by giving off ruddy fumes ( $\text{NO}_2$ ) when heated with copper and sulphuric acid, and like all neutral nitrates, it is soluble in water. Absence of chlorides and sulphates is shown by the usual tests,  $\text{AgNO}_3$ , and  $\text{BaCl}_2$ .

*In Pharmacy.*—Forms one of the sources of *Ac. Nitricum*, and it is used as an oxidising agent, e. g. in the preparation of *Sodæ Arsenias*.

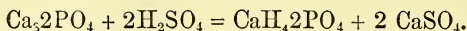
*In Medicine.*—Has been recommended in some diseases, especially dysentery, but it is not recognised for internal use in the Pharmacopœia.

### SODÆ PHOSPHAS.



*Preparation.*—The essential steps of the process are two, viz.:—

(a.) Dissolve bone ash (which is mainly  $\text{Ca}_32\text{PO}_4$ ) in sulphuric acid—



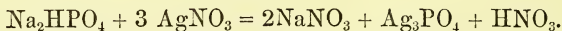
The acid (super) phosphate of calcium remains in solution; the calcic sulphate is, for the most part, precipitated.

(b.) Filter, and to the hot filtrate add carbonate of sodium—

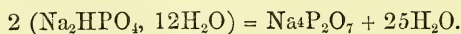


(mono-calcic phosphate). Filter from the insoluble calcic phosphate, and crystallise the solution of sodic phosphate. A little uncrystallisable acid phosphate of sodium remains in the mother liquor, but by saturating it with some more carbonate of sodium, an additional crop of crystals of Sodæ Phosphas may be obtained.

*Characters and Tests.*—The large transparent crystals speedily effloresce and become opaque and powdery on exposure to the air. They lose some of their water of crystallisation until a permanent salt is formed, viz.,  $\text{Na}_2\text{HPO}_4 \cdot 7\text{H}_2\text{O}$ . These two hydrous phosphates are isomorphous with the corresponding arseniates. Like all alkaline phosphates it is soluble in water, and being a tribasic phosphate, it gives a yellow precipitate ( $\text{Ag}_3\text{PO}_4$ ) with nitrate of silver—



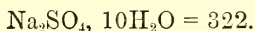
Hence, the resulting fluid acquires an acid reaction. When gently heated, it loses its water of crystallisation, and at a red heat it is decomposed and converted into pyrophosphate of sodium ( $\text{Na}_4\text{P}_2\text{O}_7$ ), and so loses 63% of its weight—



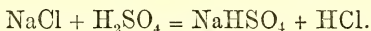
*In Pharmacy.*—Used in the preparation of some insoluble phosphates, e. g. Ferri Phosphas. A solution of 1 part in 10 of water is introduced into App. II. as a test for magnesia.

*In Medicine.*—A mild saline purgative which from its comparative tastelessness is well adapted for young children. If given in a little broth or soup its flavour will not be perceived, but a considerable dose of it ( $\frac{1}{4}$  to 2 oz.) is required. Phosphate of sodium occurs in several of the animal fluids, especially the blood and urine.

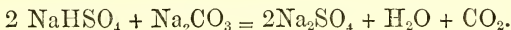
### SODÆ SULPHAS.



*Origin.*—Sodic sulphate exists in solution in many mineral springs, e.g. Cheltenham and Carlsbad, and is obtained artificially in several chemical operations. Thus, the Pharmacopœia indicates one source in the manufacture of hydrochloric acid from common salt and sulphuric acid—



Neutralise the acid sulphate with carbonate of sodium, and crystallise out the neutral sulphate—



*Characters and Tests.*—Sulphate of sodium, commonly called *Glauber's salt*, is, like most sulphates, readily soluble in water. As in the case of the borate and carbonate of sodium, its crystals contain  $10\text{H}_2\text{O}$ , but on exposure to air, they lose their transparency, and finally crumble into an opaque white powder, all the water of crystallisation being gradually given off.

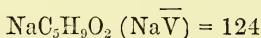
The same result is attained more quickly by heat, with a consequent loss of 60% in weight. The absence of sulphate of ammonium is shown by no ammonia being given off upon heating the salt with Liq. Pot., which would at the same time precipitate oxide of iron or manganese, if these metals were present. The purity of the salt is easily ascertained by precipitating a known

weight (50 grs.) of it completely with chloride of barium, and weighing the resulting sulphate of barium (36.18 grs.).

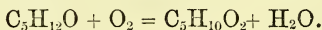
*In Medicine.*—In full doses, i. e.  $\mathfrak{zss}$ . to  $\mathfrak{z}$ i. it is an efficient cathartic, with a hydragogue tendency, but it is not often prescribed, and its place is now generally taken by sulphate of magnesium. It should be remembered, that when in an effloresced state, i. e. having lost its crystalline water, the dose must be proportionately reduced.

Sulphovinate of sodium,  $C_2H_5NaSO_4$ , has been proposed by M. Rabuteau as the most agreeable saline cathartic. It possesses a mild taste, is much more soluble than sulphate of sodium, and is well borne by the stomach. Dose,  $\mathfrak{zss}$ . to  $\mathfrak{z}$ i.

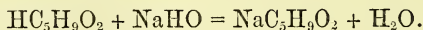
### SODÆ VALERIANAS.



*Preparation.*—Valerianic or valeric acid is not officinal except in combination with sodium and zinc. The acid was formerly derived from valerian root, but it is now usually prepared artificially. The process consists of two steps: 1. The formation of valerianic acid from fousel oil,  $C_5H_{11}$ , HO (amylic alcohol), by oxidation with potassic bichromate and sulphuric acid—\*



All alcohols yield by oxidation their proper acid, and valerianic acid bears to amylic alcohol the same relation which acetic acid bears to common alcohol (see Ac. Aceticum). 2. Saturation of this acid with caustic soda—



Some valerianate of amyl,  $C_5H_{11}$ ,  $C_5H_9O_2$ , (artificial apple oil)

\*  $K_2Cr_2O_7 + 4H_2SO_4 = (K_2SO_4, Cr_2O_33SO_4) + 4H_2O + O_3$ .

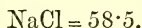


is also produced in the first instance, but this compound ether is decomposed by the soda, more valerianate of sodium being formed, and some amylic alcohol set free, which constitutes the “oil” that is directed in the Pharmacopœia to be skimmed off the surface.

*Characters.*—A snow white deliquescent salt, very soluble in water and in spirit. It possesses the disagreeable, sickening odour of valerianic acid, and this fetid volatile acid is liberated from the salt by dilute sulphuric acid. Since commercial amylic alcohol is liable to contain the next lower homologue, butylic alcohol ( $C_4H_9HO$ ), this by oxidation will yield butyric acid ( $C_4H_8O_2$ ), the next lower homologue of valerianic acid, and so the various valerianates may be contaminated with some butyrate. For the detection of butyric acid, see *Zinci Valerianas*.

*In Pharmacy.*—Used to prepare other valerianates by double decomposition. Only one of these, viz. valerianate of zinc, is officinal, but the valerianates of quinia and of iron are occasionally prescribed.

## SODII CHLORIDUM.



*Origin.*—Common salt, a product so essential to our own well being, and to that of many animals, is universally distributed over the earth, and is found native either in the solid state or in solution. In the former condition, as *rock salt* it constitutes enormous beds in various quarters of the globe, probably formed in past ages by the gradual drying up of inland seas; and very extensive mining operations are carried on for its extraction. Rock salt, although always transparent, or at least translucent, is often variously coloured from the presence of traces of iron and manganese. In solution it exists in all waters, but is found especially in certain springs and lakes, and in sea water, which contains about 2·7%. The brine

when evaporated, yields *bay* or *sea salt*. Table salt is always obtained from rock salt.

*Characters and Tests.*—When quite pure, it is permanent in the air, but if, as usually happens, it contains some chloride of magnesium or calcium, it is more or less deliquescent. Its solubility in water is little affected by temperature, and it is almost insoluble in alcohol. When gradually heated, it first crackles from the presence of interstitial moisture, then melts, and at a high temperature is volatilised unchanged. It is distinguished from potassic chloride by not precipitating with chloride of platinum; and that it is a chloride is evidenced by its giving a white precipitate with nitrate of silver, soluble in ammonia, and insoluble in nitric acid even when boiling.

*In Pharmacy.*—It is the source of Ac. Hydrochlor. When heated with mercuric or mercurous sulphate it yields  $\text{HgCl}_2$  or  $\text{HgCl}$ , respectively. Chloride of sodium must not be confounded with Liq. Sodæ Chloratæ, sometimes called chloride of soda.

*In Medicine.*—Taken internally, salt provokes salivation and promotes the gastric secretion. Being eminently a crystalloid, it is easily absorbed and passes into the blood. Not to speak of its dietetic value, salt has some useful applications in medicine. Large doses, e. g.  $\text{ʒss.}$  to  $\text{ʒi}$  in solution, will act as a prompt and efficient emetic, or if not rejected, as a purgative. But for the latter purpose it is more commonly employed as an enema, one or two tablespoonfuls in Oi. of water. An injection of salt is a simple and effectual means of removing ascarides from the rectum. Salt is reputed to possess antiperiodic powers in the treatment of intermittent fever; and as a styptic, a common and sometimes a very successful remedy for a sudden attack of hæmoptysis consists in the administration of a teaspoonful of chloride of sodium taken dry.

As a lotion it may be used in sprains and bruises, and a salt bath (1 lb. to Cong. iv.) is considered by some to be a useful tonic in cases of debility.

*SPIRITUS.*

Medicated spirits are alcoholic solutions of an essential oil or other volatile principle. They differ from the Essences simply in being much weaker, and from Tinctures chiefly in being precise solutions of definite principles, and not of the crude drug. Most of the spirits might be termed Tinctures of Essential Oils. They are prepared either (*a*) by direct solution of the volatile principle in alcohol, as in the majority of cases; or (*b*) by distillation, e. g. Spir. Æth. Nitr.; Spir. Ammon. Arom.; Spir. Ammon. Fœt.; Spir. Armor. Co. All except Spir. Armor. Co. are prepared with rectified spirit. In the case of Spir. Ammon. Fœt. the assafoetida is macerated for a day with the spirit before distillation, since the volatile oil when thus dissolved rises more readily with the spirituous vapour.

The strengths of the simple spirituous solutions are—

1 in 3	.	.	.	Spir. Ætheris.
1 — 10	.	.	.	Spir. Camphoræ.
1 — 20	.	.	.	Spir. Chloroformi.
1 — 50	.	.	.	Spir. Cajuputi, Juniperi, Lavan- dulæ, Menthæ Pip., Myristicæ, Rosmarini.

The medicated spirits are obviously stimulant in their action, and are used chiefly to impart a pleasant odour and flavour to mixtures, to correct the griping or other unpleasant effects of various medicines, and as carminatives in flatulent affections.

*SPIRITUS ÆTHERIS.*

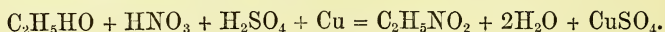
A simple solution of ordinary ether in twice its bulk of rectified spirit, i. e. it contains 1 part of ether in three. It affords a convenient means of prescribing ether in a mixture. Under the

name Spir. Æth. Co. (Spir. Æth. Oleosus) a preparation is often prescribed which represents the old formula known as "Hoffmann's anodyne liquor." It differs from the officinal Spir. Ætheris in containing in addition some *heavy oil of wine*, and is believed to possess tranquillising and anodyne properties superior to the officinal spirit.

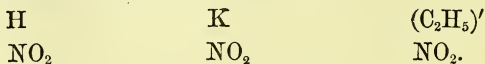
*In Pharmacy.*—It is used as a solvent in preparing Tr. Lobeliæ Ætherea.

### SPIRITUS ÆTHERIS NITROSI.

*Preparation*—The officinal spirit of nitrous ether is a solution, in variable proportions, of nitrous ether ( $C_2H_5NO_2$ ) in rectified spirit, usually associated with some aldehyd. Various methods have been proposed for its preparation, and in the authorised process (Redwood's) a concentrated solution of nitrous ether in spirit is first prepared, and then diluted with nearly three times its bulk of rectified spirit. When rectified spirit is *cautiously* heated with a little sulphuric acid, nitric acid, and copper wire, a complicated reaction ensues; aldehyd ( $C_2H_4O$ ), and other secondary products are formed, but the main point in the decomposition may be represented by the following equation:—



*Characters and Tests.*—Nitrous ether (improperly termed *nitric* ether)\* is one of the two organic nitrites in the Pharmacopœia, the other being nitrite of amyl. Its relation to nitrous acid is precisely similar to that of any inorganic nitrite, e. g.  $KNO_2$ , as is seen from these formulæ,



The radical, ethyl ( $C_2H_5$ ) replaces the H of the acid, and hence its true chemical name is *nitrite of ethyl*.

\* The formula of nitric ether is  $C_2H_5NO_3$ .

Pure nitrite of ethyl is a pale yellow, neutral liquid, with a fruity smell, and boils about 62° F. The ordinary diluted spirit of nitrous ether is nearly colourless, and from its agreeable odour and taste, is commonly termed *sweet spirit of nitre*. It was formerly prepared from nitre.

A pungent odour and acrid taste would indicate aldehyd or other impurity.

This preparation is liable to undergo certain spontaneous changes, and is besides frequently and scandalously adulterated. The sp. gr. is no reliable criterion of its quality. It is never quite free from aldehyd, (detected by forming a brown resinoid mass with caustic potash), and often contains free acids, e. g. acetic acid (generated by oxidation of the aldehyd), and nitrous or nitric acid. Old specimens are apt to contain oxalic, formic, glycolic, and glyoxylic acids, and probably other bodies also.

Free acid is detected by reddening blue litmus paper, and by effervescence upon agitation with a little bicarbonate of sodium.

Free nitrous or nitric acid may also be recognised by their colouring blue a piece of paper previously dipped in simple tincture of guaiacum (see *Guaiaci Resina*).

These free acids operate injuriously by their chemical reactions with other substances, e. g. KI, ferrous salts, &c., when sweet spirit of nitre is prescribed in mixture. The acid may be neutralised by previously shaking up the spirit of nitrous ether with a few crystals of bicarbonate of potassium.

The nitrous acid radical in the officinal spirit may be proved to exist in it by adding a little ferrous sulphate and sulphuric acid, when a brown compound is produced, owing to the absorption of nitric oxide by the ferrous sulphate (see *Acidum Nitricum*).

Alcohol and water are often fraudulently added to this compound. The best test of its quality consists in agitating some of the nitrous spirit of ether with twice its bulk of a *saturated* solution of chloride of calcium; this absorbs *all* the alcohol

and water; and a certain proportion of pure nitrous ether, at least 2%, should rise to the surface, while about 8% of the ether is said to remain in solution, i. e. the preparation should contain in all, 10% of the ether.

*In Medicine.*—Sweet spirit of nitre is extensively employed as a diaphoretic and diuretic, and often proves a grateful stimulus in restless and irritable conditions. For diuretic purposes it is usually conjoined with other agents of that class, such as squill, digitalis, acetate and nitrate of potassium, &c. Its diuretic properties appear to be less decided than is commonly supposed, and probably depend upon its stimulating action on the heart. In febrile affections it is frequently used as a stimulant diaphoretic, and it may be judiciously combined with aromatic spirit of ammonia.

This ethereal spirit is a narcotic poison, and death has been occasioned by the accidental inhalation of its vapour during sleep.

### SPIRITUS AMMONIÆ AROMATICUS.

This preparation, commonly known as *sal volatile*, is a spirituous solution of ammonia and neutral carbonate of ammonium, flavoured with lemon and nutmeg.

When diluted with water, it forms a white turbid mixture, owing to the precipitation of the volatile oils. Commercial specimens are frequently deficient in the proportion of ammonia.

*In Pharmacy.*—Used in preparing the Tinct. Guaiaci Ammon., and Tinct. Valer. Ammon.

*In Medicine.*—An agreeable aromatic stimulant, often employed in sick headache, and frequently added to aperient draughts, and to various mixtures so as to render them more palatable.



## SPIRITUS AMMONIÆ FŒTIDUS.

Is an alcoholic solution of volatile oil of assafoetida, containing free ammonia.

A stimulant antispasmodic used in the treatment of nervous and hysterical cases.

The odour of assafoetida clings persistently to any vessel that contained it. The addition of a few drops of prussic acid, or of essential oil of almonds, materially aids in its removal.

## SPIRITUS ARMORACIÆ COMPOSITUS.

Is an alcoholic solution of volatile oil ( $C_4H_9CyS$ ) of horse-radish, i. e. sulphocyanate of butyl, flavoured with orange peel and nutmeg.

A stimulant diuretic, but seldom prescribed.

## SPIRITUS CAJUPUTI.

An aromatic diffusible stimulant (see Oleum Cajuputi). Strength, 1 in 50.

## SPIRITUS CAMPHORÆ.

Used chiefly externally as an anodyne lotion in rheumatic pains, chilblains, sprains and bruises. It is also prescribed internally, and it should be remembered that the greater part of the camphor is precipitated on the addition of water, but it may be suspended by means of sugar. Strength, 1 in 10.

## SPIRITUS CHLOROFORMI.

An alcoholic solution of chloroform, 1 in 20. A solution containing 1 part in 10 was formerly in use, but on account of the insolubility of chloroform in water, when it was diluted, much

of the chloroform was precipitated. The same objection applies to the present Tinct. Chlorof. Co.

This preparation is frequently, although quite erroneously, termed chloric ether, for it contains no ethereal compound. It was at one time used as an anæsthetic agent instead of chloroform, but the difference in the boiling points of the two liquids in the Spir. Chlorof. is too great to render such a practice advisable. It is frequently added to expectorant and other mixtures, but the proportion of chloroform is so small necessarily, that it is almost inoperative as a remedy. It simply serves to give a sweet flavour to the mixture, and to cover the taste of nauseous medicines.

### SPIRITUS JUNIPERI.

A weak solution of oil of juniper, chiefly used as an ingredient in diuretic mixtures, and it also serves to cover the taste of the creasote in Mist. Creasoti. Strength, 1 in 50.

### SPIRITUS LAVANDULÆ.

An agreeable aromatic perfume, used to flavour other medicines. The preparation sold under the name of "lavender water" is really a tincture of oil of lavender and other odorous substances. Strength, 1 in 50.

### SPIRITUS MENTHÆ PIPERITÆ.

In popular use as a carminative under the name of "essence of peppermint." It has a remarkable power of concealing the flavour of nauseous medicines, and is frequently added to mixtures for that purpose. Strength, 1 in 50.

### SPIRITUS MYRISTICÆ.

An agreeable aromatic, sometimes used as an adjunct to other medicines, e. g. Mist. Ferri Co. Strength, 1 in 50.

## SPIRITUS ROSMARINI.\*

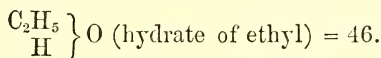
An aromatic perfume chiefly used as an ingredient in lotions and liniments. Strength, 1 in 50.

(a.) ALCOHOL† (ABSOLUTE). App. I.

(b.) SPIRITUS RECTIFICATUS.

(c.) SPIRITUS TENUIOR.

(d.) SPIRITUS VINI GALLICI.



Spirit of wine, or common alcohol, is the most important member of a group of compounds which manifest a close analogy with each other, both in chemical composition and in the decompositions of which they are susceptible, and a sketch of their general characters was given under *Alcohol Amylicum*, p. 80.

Ordinary vinic or ethylic alcohol is the second monatomic alcohol in the Pharmacopœia, and is obtained by subjecting to distillation any saccharine solution that has undergone fermentation. Both cane and grape sugar yield alcohol by fermentation, but the cane sugar must first pass into grape sugar (glucose); the main reaction which occurs is— $\text{C}_6\text{H}_{12}\text{O}_6 = 2\text{C}_2\text{H}_6\text{O} + 2\text{CO}_2$ .

Minute quantities of the higher homologous alcohols (tritylic, tetrylic, amylic, and hexylic), are at the same time formed, and traces of other bodies, e. g. glycerin, and succinic acid.

All fermented liquors, wines, liqueurs, and spirits, therefore,

\* This Spirit is noticed out of its order so as to allow of the three varieties of alcohol being considered together.

† The word *Alcohol* is of Arabic origin.

contain alcohol, and the manifold varieties of alcohol are named according to their strength, colour, flavour, and the nature of the saccharine liquid from which they are procured. Thus, of fermented liquors which are used *without* subjecting them to distillation, we have the innumerable kinds of *wine*, from the juice of the 500 or 600 varieties of grape which are cultivated; *beer*, *ale*, and *porter*, from infusion of malt, flavoured by the aromatic bitter of the hop; *cider* and *perry* from the juice of the apple and pear respectively. To these we may add *koumiss*, obtained from milk, and which has been lately proposed for use in medicine.

In all these liquors the alcohol is diluted with abundance of water, but by distillation it is possible to separate the alcohol in a more concentrated form, and so to obtain the different ardent spirits of commerce. For instance, *brandy* (Spir. Vini Gall.) is procured from wine; *rum*, from molasses; *whisky*, from malted barley or rye which has been dried over a peat fire; *gin* is a form of whisky flavoured by distilling it with turpentine (common gin), or juniper fruit (Holland gin); *arrack* from rice, &c.

The forms under which ethylic alcohol occurs in the Pharmacopœia are these, in the order of their strength:—

Absolute Alcohol,	.	.	.	100	per cent.		
Rectified Spirit,	.	.	.	84	„	by weight.	
Brandy,	.	.	.	48–56	„	„	
Proof Spirit,	.	.	.	49	„	„	
Sherry,	.	.	.	17–18	„	„	
Orange Wine,	.	.	.	12	„	„	

The term alcohol is, in common language, very loosely applied to spirit of various strengths, but it ought to be restricted to the pure or absolute alcohol of chemists.

#### (a.) ABSOLUTE ALCOHOL. App. I.

*Preparation.*—To separate the pure alcohol from the water with which it is mixed in rectified spirit, the latter is first

digested with potassic carbonate for two days. This deliquescent salt absorbs most of the water, and moreover is insoluble in alcohol. The spirit having been decanted from the heavier aqueous solution of potassic carbonate is distilled over excess of fresh burnt quick lime, and anhydrous or real alcohol is thus obtained. It is impossible to obtain absolute alcohol by ordinary distillation alone.

*Characters and Tests.*—Besides the characters given in the Pharmacopœia, it may be mentioned that pure alcohol has never been frozen even at a temperature of  $-166^{\circ}$  F. It should be free from unpleasant odour, which when present, is due to fousel oil, and it combines in all proportions with ether and water, forming *transparent* solutions. Its union with water is attended by a contraction in bulk and a rise in temperature; hence the observed density of a mixture of alcohol and water is greater than its calculated mean density. The condensation is greatest in the proportion of  $C_2H_6O + 3H_2O$ . Its boiling point is  $173^{\circ}$  F., and when burned in the air it emits but little light (as illustrated in an ordinary spirit lamp), and is wholly converted into carbonic acid and water— $C_2H_6O + 3O_2 = 2CO_2 + 3H_2O$ . The presence of water may be detected by adding a little *white* anhydrous sulphate of copper which becomes *blue* by hydration ( $CuSO_4, 5H_2O$ ) if water be present (Cassoria).

*In Pharmacy.*—Used as a test for the purity of castor oil (see Oleum Ricini) which is soluble in an equal bulk of alcohol; whereas most fats and fixed oils are very sparingly soluble in it. Chloral is prepared from absolute alcohol.

Since alcohol, when oxidised, yields acetic acid, malt liquors and wine are capable of furnishing this acid, and are in fact the sources of vinegar (see Acetum).

*Tests for Alcohol.*—(1). Separation from the substance or solution by fractional distillation; recognised by its odour and other characters. (2). Heat with sulphuric acid and a little red (bi) chromate of potassium; an emerald green colour is produced, owing to reduction of the chromium salt. (3). Lieben's iodoform

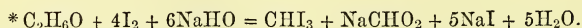
test:—add to the suspected liquid, warmed, a little iodine and soda, and let it stand.\* If alcohol be present, a yellow crystalline deposit of *iodoform* is obtained, which, if in very small quantities, may be recognised under the microscope as hexagonal plates.

### (b.) SPIRITUS RECTIFICATUS.

This is the form of spirit resulting from the ordinary distillation of ardent spirits.

*Characters and Tests.*—Rectified spirit is often spoken of as 56° over proof. This means that in order to reduce it to the strength of proof spirit (49%), 100 vols. must be mixed with water, until after contraction, they measure 156 vols. Nearly 60 vols. of water are necessary for this purpose.

The odour and flavour should be purely alcoholic, and the spirit should remain clear when diluted with water. If this be not the case, the presence of fousel oil is indicated, and the presence of any reducing agent, such as fousel oil, aldehyd, or aldehydic acid, is chemically tested by the addition of nitrate of silver, which is reduced by them to a black metallic powder. Any quantity beyond a mere trace of these bodies renders the spirit unfit for use in medicine. Spirit of wine (often for brevity termed alcohol) and proof spirit, are solvents of great value to the chemist and pharmacist, especially as they exert but little chemical action upon the bodies they dissolve, and owing to its volatility, the alcohol is easily separated from them, if necessary, by a gentle heat. For example, alcohol readily dissolves iodine (Tinct. Iodi), and bromine, the alkaloids (e.g. Liq. Atropiæ), volatile oils (e.g. the Spirits), resins, balsams, and many



But other substances beside common alcohol give a similar reaction, and there seems to be a substance in human urine, even in that of a teetotaller, and in that of some animals, which answers to the iodoform and other tests for alcohol, and yet does not appear to be alcohol. (See p. 655.)



gum resins (e.g. Tinct.<sup>a</sup> Assaf., Cann. Indicæ, Myrrhæ, Tolut., &c.). Most of the deliquescent salts, except potassic carbonate, are soluble in alcohol, but the efflorescent salts (carbonate of sodium), and those which are sparingly soluble in water, are usually insoluble in it. It dissolves most of the soluble chlorides, but none of the metallic sulphates. Most acids act on it, forming (*a*) ethers proper, e.g. Æther; (*b*) compound ethers, e.g. Sp. Æth. Nitrosi.

What is sold as *methyiated spirit*, duty free, for the use of manufacturers, is rectified spirit of wine, containing 10% of wood spirit (methylic alcohol,  $\text{CH}_4\text{O}$ ), which while it does not interfere with technical applications, prevents, by its nauseous taste and odour, the liquid from being taken internally.

### (c.) SPIRITUS TENUIOR.

Proof spirit, i. e. containing 49% by weight of absolute alcohol, is obtained by simply diluting rectified spirit to the proper amount. Five vols. of the latter mixed with 3 of water will yield 7·8 vols. of proof spirit. The term derives its origin from the rude method of testing formerly in use, in which gunpowder was moistened with the spirit to be tried, and the alcohol ignited. If it fired the powder, it was said to be *over proof*, but if the spirit burned off and left the powder damp, it was said to be *under proof*. The weakest spirit capable of thus firing powder had a sp. gr. of about 0·920, i. e. corresponding to the officinal proof spirit, which retains the old name. Every additional 0·5% of absolute alcohol is said to be *one degree* over proof.

### (d.) SPIRITUS VINI GALLICI.

Brandy (i. e. *Branntwein*, burnt or distilled wine) is a coloured and flavoured form of alcohol distilled from French wine. It contains on an average about 50% of absolute alcohol, and for medicinal use it should be free from disagreeable odour, and not

less than four years old. The general characters and varieties of brandy are well known, but a factitious brandy is sometimes made from rectified spirit diluted to the proper strength, and flavoured with acetic ether.

*In Pharmacy.*—On account of its extensive solvent powers alcohol in one form or another is largely employed in pharmaceutical operations. For example, in the extraction of most of the alkaloids, of digitalin and santolin, and of resins. It is used in the preparation of Pil. Scammonii Co. All the Tinctures (68) are prepared with spirit, rectified spirit being used (in 23 cases) whenever the substance contains much oily, resinous, or other matter that would be insoluble in the weaker proof spirit. Similarly, in the case of certain of the Extracts and Liniments.

Conjoined with ether it dissolves gun cotton (see Collodium), and serves to separate pure ox bile from the associated mucus. On account of the insolubility of ferrous sulphate in alcohol, rectified spirit is used in the preparation of Ferri Sulph. Granulata. All the Spirits are prepared with rectified spirit except Spir. Armor. Co. As a preservative agent it is employed in the Extracta Liquida, some of the Syrupi, and in the Succ.

By decomposition, alcohol yields ether, chloroform, chloral, acetic ether, and sweet spirit of nitre.

*In Medicine.*—On such a large and important subject as the action and uses of alcohol it would be impossible to enter into details here, and nothing more will be attempted than a sketch of a few important points. First, then, as a poison, large doses of alcohol are capable of producing a comatose or apoplectic state, which often proves fatal, and has not unfrequently been confounded with true cerebral apoplexy.

In acute alcoholism, three principal stages, with intermediate gradations, may be recognised in the functional disorders produced by spirituous liquors: 1. Slight ebriety, marked by excitement and gaiety; 2. Confirmed intoxication, accompanied

by loss of volition, delirium, staggering, drowsiness, &c.; 3. Comatose or apoplectic intoxication, sometimes convulsive (Gubler).

When taken for a length of time in excess, it exercises a most pernicious influence on the nutrition of the body, causes degeneration of the tissues, with a special tendency to the formation of connective tissue, and in short, it helps time to produce the effects of old age. Even if delirium tremens do not ensue, the constitution is undermined, the power to resist disease is lowered, and drunkards will succumb to accident or disease which a temperate man might easily overcome.

Alcohol is readily absorbed by the venous system of the stomach and intestines, and it exercises a stimulant and even irritant action on the viscera which it traverses, primarily on the liver.

In its general physiological action, alcohol is undoubtedly a powerful stimulant, quickly making itself felt, and notably exciting the circulatory and nervous systems.

Although the course which alcohol takes through the system is not fully known, the fact that it is in large part consumed within the body seems to be certainly established, and comparatively little escapes unchanged with the urine.

A serious fallacy underlies the detection of alcohol in urine, if Dr. Dupré's curious observation be confirmed. He states that a substance was found in the urine after six weeks of total abstinence, and even in that of a teetotaller, which gave the reactions ordinarily employed for the discovery of small quantities of alcohol (e. g. it responded to the iodoform test), and a volatile product was obtained possessing the odour and chemical properties of acetic acid.

The maximum quantity of pure alcohol, no matter how diluted, which can be safely taken *per diem* in health, without impeding digestion or assimilation, may be stated at  $1\frac{1}{2}$  ounces, and in the abstract, it must be allowed that alcohol, at least in

the form of ardent spirits, is not *needed* by the healthy, vigorous man; but in the case of malt liquors and wines, the value of the other ingredients beside the alcohol is not to be overlooked.

Contrasted with ether and chloroform, the early stage of excitement and intoxication from alcohol is much longer; and since a condition of insensibility and unconsciousness is not reached until dangerously large quantities have been taken, alcohol is quite inadmissible as an anæsthetic.

As a therapeutical agent its quickening effects upon the appetite and circulation are the practical points to seize, and while it is unlikely that alcohol can enable the body to perform more work on less food, yet by spurring a failing heart it may enable work to be done which otherwise could not be performed. Its action in accelerating a languid capillary circulation is one of its most useful properties.

As familiar examples of the uses of alcohol internally may be instanced, its employment in many cases of torpid digestion, and in the prostration attendant on severe acute illness, miasmatic or septic absorption, exposure to cold, blood poisoning, acute diarrhœa, &c.—in short, wherever the vital powers are suddenly imperilled by any debilitating cause, or by threatened failure of the circulation. In many cases the stimulant should be given with food, and repeated frequently, rather than administered in large doses at one time.

The invariable necessity for moderation and caution in the use of alcohol cannot be too strongly inculcated, and not only are the immediately pernicious effects of an injudicious use of it to be guarded against, but the possibility of its use under medical advice leading to confirmed habits of tipping should be carefully borne in mind.

*Externally*, alcohol, in some form, is a principal ingredient in most evaporating lotions; it is applied to the skin in cases of incipient bed sore, bruises, erysipelas, &c., and is sometimes injected, more or less diluted, into the sac of a hydrocele to ex-

cite adhesive inflammation. When applied to a living tissue it abstracts and combines with the water of the structure, and coagulates albuminous matter.

## STRAMONII FOLIA.

## STRAMONII SEMINA.

*Origin.*—The Thorn Apple, *Datura Stramonium*,\* N. O. Solanaceæ, is a vigorous annual plant which grows freely in Britain, although it is uncertain to what country it originally belonged. The fruit is a large, ovoid, four-valved capsule, filled with the numerous seeds, and thickly covered with sharp spines, hence its common name.

*Characters*—(a) of *Leaves*.—The large, dark green, ovate-triangular leaves on short footstalks in the forks of the stem, are irregularly toothed at the edges, and emit when bruised a rank, fetid odour, which disappears after they have been dried.

(b) Of *Seeds*.—The seeds are inodorous unless bruised, but are distinguished by their small size, and wrinkled, kidney shaped form; like the leaves, they possess a bitter, nauseous taste.

The only important constituent of the plant is atropia, although at first the alkaloid of stramonium was believed to be a distinct base which was named *daturia*. The seeds yield more atropia than the leaves.

*In Medicine.*—Stramonium has been long known as a poisonous and intoxicating herb, and was introduced into practice by Stoerck.

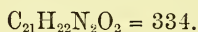
It is a powerful narcotic, and has often caused death. Its general effects correspond closely with those already described under *Belladonna*, viz., vertigo, unpleasant sensations in the throat, dimness of vision with dilatation of the pupil, delirium,

\* *Stramen*, straw; from its fibrous roots.

tremor, and even convulsions. Several cases of temporary aphasia have been observed to follow a full dose of stramonium.

It was at first lauded in the treatment of mania and epilepsy, but is now chiefly employed in the relief of pain and spasm, especially in spasmodic asthma, the paroxysms of which it often effectually relieves. For this purpose it is best taken into the lungs by smoking the dried leaves, or cigarettes properly prepared, but its use in this way requires caution. When smoked it causes dryness of the throat. If administered internally,  $\frac{1}{2}$  gr. of the Extract, or 20 m. of the Tincture, may be given.

### STRYCHNIA.



*Origin.*—Strychnia exists in small quantities, from 0·4 to 0·5%, in *Strychnos Nux vomica*, N. O. Loganiaceæ, and in larger quantities, 1·2 to 1·5%, in St. Ignatius' bean, *Strychnos Ignatii*. It is combined with lactic and perhaps other acids (igasuric). Two other alkaloids are associated with it, viz., brucia and igasuria.

*Preparation.*—The main steps of the process are these:—

1. Exhaust the powdered seeds with diluted spirit of wine, which dissolves out the native salts of the alkaloids, strychnia and brucia.

2. To the spirituous extract redissolved in water add acetate of lead, which precipitates the colouring matter and the vegetable acids, and forms soluble acetates of strychnia and brucia.

3. Filter, and to the filtrate add ammonia, which precipitates the strychnia and brucia. Dry the precipitate, redissolve in spirit, and by evaporation crystallise out the strychnia, the greater part of the more soluble brucia remaining in the mother liquid.



*Characters and Tests.*—One of the most distinctive characters of strychnia is its extreme bitterness, which is so intense that one part of it is said to communicate a bitter taste to about half a million parts of water.

Even at the boiling temperature it requires over 2000 parts of water to dissolve it, and nearly 7000 parts at 50°, i. e. 1 gr. in 3xvi.

The fixed and volatile oils take it up, but the best solvent is chloroform, which accordingly is used in searching for strychnia in organic mixtures in cases of poisoning.

The best *colour test* for strychnia consists in the effect of oxidising agents upon it in sulphuric acid solution. These produce with it a splendid violet purple colour, soon fading into a dull red. It is stated that  $\frac{1}{30000}$  part of a grain may be thus detected.

The best mode of proceeding is that advised in the British Pharmacopœia, viz.: To the strychnia add a little strong sulphuric acid, and then a minute fragment of red (bi) chromate of potassium (Otto), when the distinctive colour will be obtained.\* Instead of potassic bichromate, other oxidising agents may be used, e. g. peroxide of lead (Marchand); red prussiate of potash (E. Davy); peroxide of manganese, chlorate of potassium, permanganate of potassium, &c.

Strong sulphuric acid, whether hot or cold, has no action on pure strychnia. Strong nitric acid does not colour strychnia in the cold, and on heating, merely turns it yellow. But commercial strychnia is seldom free from brucia ( $C_{23}H_{25}N_2O_4 \cdot 4H_2O$ ), and this alkaloid is readily detected by the deep red colour it assumes on the addition of nitric acid (see Cusparia).

The *physiological test* proposed by Dr. Marshall Hall, consists in ascertaining the action of the poison on frogs, by injecting a

\* Aniline and curarin give similar colours when thus treated.

little of it beneath the skin. 1 part of strychnia in 10,000 of solution will cause tetanic spasms within half an hour.

*In Pharmacy.*—The salts of strychnia are for the most part soluble and crystallisable, and the officinal Liq. Strychniæ is really a solution of hydrochlorate of strychnia in water and spirit, containing 4 grs. to  $\text{ʒi}$ . Nitrate, hydrochlorate, and sulphate of strychnia, which are sometimes prescribed, are all soluble in about fifty parts of cold water.

*In Medicine.*—The effects of strychnia are identical with those of Nux vomica, under which head its action and uses are described.

Strychnia is said to be about six times as active as the extract of nux vomica.

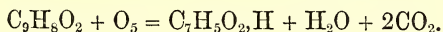
### STYRAX\* PRÆPARATUS.

*Origin.*—Storax is a balsamic substance obtained from the inner bark of Liquidambar orientale, N.O. Altingiaceæ. The term Storax is also applied to an exudation from a totally different tree, Styrax officinale, and other species, N. O. Styra-cæ, but within modern times this scarce and valuable kind of storax has wholly disappeared from commerce.

*Characters.*—The quality and characters of storax vary considerably, and it is often much adulterated. The officinal variety is that known as liquid storax; its odour recalls that of Peruvian balsam, but it is less agreeable, and when heated, it melts, takes fire, and burns with a white flame. Its chief components are a volatile oil termed styrol ( $\text{C}_8\text{H}_8$ ); resin; styracin (i. e. cinnamate of cinnamyl,  $\text{C}_9\text{H}_9$ ,  $\text{C}_9\text{H}_7\text{O}_2$ ); and cinnamic acid ( $\text{C}_9\text{H}_5\text{O}_2$ ), an ally of benzoic acid, from which it is distinguished by evolving on oxidation (e. g. with  $\text{K}_2\text{Cr}_2\text{O}_7$  and  $\text{H}_2\text{SO}_4$ ), the characteristic

\* Στύραξ, a reed; because formerly brought from Syria in reeds.

odour of hydride of benzoyl (oil of bitter almonds)—



*In Medicine.*—Like the other balsams, storax is a stimulating expectorant, but it is seldom used at present, and could be spared from the only preparation in which it occurs, viz., Tinct. Benz. Co. It is said to cover the strong odour and taste of opium in pill better than anything else.

### SUCCI.

The Succi, which were proposed by Mr. Squire in 1835, are now made officinal as a distinct class of preparations. They consist of the expressed juices of fresh plants, preserved from mouldiness by the addition of one-third of their bulk of rectified spirit.

Besides the five mentioned below, three others occur in the British Pharmacopœia, and have been already noticed, viz., Limenis Succus, Mori Succus, and Rhamni Succus.

These eight Succi should properly be grouped under the same heading.

### SUCCUS BELLADONNÆ.

A valuable preparation. Six parts correspond to about 10 of the fresh herb.

### SUCCUS CONII.

Dr. J. Harley has conclusively shown that this is the best and indeed the only reliable preparation of hemlock.

In order to produce its physiological action, much larger doses than those recommended in the British Pharmacopœia must be given, and ʒi. of the succus may be safely administered to a robust adult.

For its uses in medicine, see p. 255.

## SUCCUS HYOSCYAMI.

A useful addition to the preparations of henbane. Seven parts correspond to 10 of the fresh herb.

## SUCCUS SCOPARII.

A useful diuretic preparation. See *Scoparii Cacumina*.

## SUCCUS TARAXACI.

A mild laxative and tonic, not often prescribed.

## SULPHUR\* PRÆCIPITATUM.

## SULPHUR SUBLIMATUM.

S = 32.

*Origin*.—Sulphur is found, free or in combination, in the three kingdoms of Nature:—

(1) In the animal kingdom, it occurs as a constituent of various tissues, especially of the albuminous (protein) group of substances, and in the bile.

(2) In the vegetable kingdom, it is particularly abundant in certain essential oils, especially those derived from the N. O. Cruciferae (mustard, horseradish), and Liliaceae (assafoetida, garlic).

(3) In the mineral kingdom, it is extracted either from its combinations (sulphides) with metals, Fe, Cu, &c., or like most of the sulphur used in medicine, from the native sulphur of Sicily, where it occurs abundantly in association with blue clay.

\* *Sal*, or *sul*, a salt;  $\pi\bar{\upsilon}\rho$ , fire; from its combustible nature.

Sulphureous waters (e. g. Harrowgate, Lisdoonvarna) contain  $\text{H}_2\text{S}$  gas in solution.

*Chemical relations.*—Sulphur acts as a diad in all its Pharmacopœial compounds, except perhaps iodide of sulphur,  $\text{S}_2\text{I}_2$  where it apparently behaves as a monad.

It is a member of a class which includes O, Se, and Te, and a striking parallelism is observed between the oxides and sulphides. All its acid compounds without exception are dibasic. To test for sulphur in combination (as sulphide), add an acid, e. g.  $\text{HCl}$ , and the fetid odour of  $\text{H}_2\text{S}$  will be evolved.

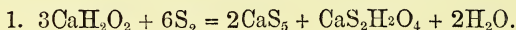
*Preparation of Sulphur Sublimatum.\**—The native sulphur earth, or the metallic sulphide (copper or iron pyrites) as the case may be, yields up its sulphur by simple fusion, or by sublimation. If the vaporised sulphur be allowed to condense in large chambers it collects on the walls and floor as a fine powder, and constitutes sublimed sulphur, or *flowers of sulphur*. When melted and cast into cylindrical moulds, it constitutes the *roll sulphur* or *cane brimstone* of commerce. Sulphur when obtained by roasting copper or iron pyrites, is apt to be contaminated with arsenic, in the form of orpiment,  $\text{As}_2\text{S}_3$ ; but Sicilian sulphur being volcanic, is not subject to this impurity.

*Characters and Tests of Sublimed Sulphur.*—Sublimed sulphur is physically distinguished from precipitated sulphur by its canary yellow colour and gritty feel. Sulphur is not only dimorphous (prismatic, and octahedral), but is also remarkable for the different allotropic forms it assumes, viz., yellow, brown, red, and plastic or soft sulphur. In the latter respect it finds a parallel in phosphorus. Sulphur is insoluble in water and ammonia, but is sparingly soluble in various other fluids, such as the fixed and volatile oils. The best solvent for it as well

\* Sublimed sulphur will be described first, as the other variety is prepared from it.

as for phosphorus is bisulphide of carbon. At a temperature of 300° F. sulphur inflames, burns with a blue light, and evolves pungent, suffocating fumes of  $\text{SO}_2$  gas. It often reddens moistened litmus paper, owing to the presence of a little sulphuric acid, formed by slow oxidation in the air. It may be freed from acidity by careful washing with hot water. Orpiment ( $\text{As}_2\text{S}_3$ ) is easily detected in and removed from sublimed sulphur by its solubility in ammonia; the filtered solution, when evaporated to dryness, will leave a yellow residue if any orpiment be present. Roll sulphur becomes highly electrical by friction.

*Preparation of Precipitated Sulphur.*—The conversion of sublimed sulphur into the more finely divided precipitated sulphur involves two steps—(1) Dissolve the sublimed sulphur by boiling it with slaked lime and water; (2) Precipitate the sulphur from this deep yellow solution by hydrochloric acid—



Remove all traces of the chloride of calcium (which is very soluble) from the precipitated sulphur by washing, and dry at a temperature not exceeding 120°.

Some  $\text{H}_2\text{S}$  is set free by a secondary decomposition. If sulphuric acid were used instead of hydrochloric acid, as is often the case, the precipitated sulphur would be contaminated with much sulphate of calcium, which is nearly insoluble.

*Characters and Tests of Precipitated Sulphur.*—Easily known from the other variety by its dull white colour, and smooth, impalpable feel. If it have a white satiny appearance, calcic sulphate is almost certainly present, and may be detected by its crystalline

\* Compare this reaction with that which occurs when sulphur and an alkaline carbonate are *fused* together, as in Potassa Sulphurata.



form under the microscope, and by a white ash remaining when the sulphur is ignited.

From its colour it was formerly called *milk of sulphur* (lac sulphuris). Many specimens of commercial precipitated sulphur contain  $\frac{2}{3}$  of their weight of calcic sulphate, and some as much as  $\frac{3}{4}$ . Owing to its state of fine division, precipitated sulphur is more liable to undergo oxidation and form sulphuric acid.

*In Pharmacy.*—Sulphur is used in the Empl. Ammon. c. Hydr. and the Empl. Hydrarg. to facilitate the subdivision of the metal. By its union directly with heated iron, ferrous sulphide (App. I.) is formed, which is the usual source of  $H_2S$  for analytical purposes, and by its combustion it yields sulphurous acid gas, the first step in the preparation of Ac. Sulphuricum.

*In Medicine.*—The chief action of sulphur when taken internally in a full dose is as a gentle laxative, acting slowly and occasioning solid stools, but it has also been long recommended in chronic rheumatism and other affections. An objection to its continued use is the fetid odour which the patient exhales from the whole surface of the body, due to the formation of sulphuretted hydrogen.

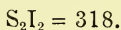
Externally, it is a popular application in sciatica and chronic articular rheumatism, but its most general use is in the treatment of scabies, which affection it readily cures. In the pustular or severe forms of vesicular scabies, sulphur ointment is too irritating to be admissible, and other remedies must be adopted.

Sulphur will also destroy the vegetable parasites in the various forms of Tinea, and it supplies a useful stimulant locally in some non-parasitic skin diseases, e. g. acne.

Precipitated sulphur forms a lighter coloured and smoother ointment, but custom has adopted the sublimed sulphur for that purpose.

The Conf. Sulph., or sulphur electuary, is the usual form for administering sulphur internally.

## SULPHURIS IODIDUM.



*Preparation.*—The process which is adopted from the French Codex consists simply in effecting a combination of the two elements by a gentle heat.

*Characters and Tests.*—Subiodide of sulphur is an unstable compound with a strong odour of iodine, and bears some resemblance to the black sulphide of antimony. It is rapidly decomposed, when in powder, by some of the volatile oils, and by continued boiling with water is thoroughly disintegrated, all the iodine escapes with the steam, and 20% of sulphur is left behind.

*In Medicine.*—Used only externally in the form of ointment, or solution in glycerin, in various skin diseases, especially chronic psoriasis, obstinate ringworm, and lupus. The preparation employed in certain skin diseases, under the name of “hypochloride of sulphur,” consists of flowers of sulphur, impregnated with a small quantity of chloride of sulphur,  $\text{S}_2\text{Cl}_2$ , obtained by passing Cl over S.

## SUMBUL RADIX.

*Origin.*—Although Sumbul or jatamansi root has long been used in various parts of Asia, both as a perfume and as a medicine, its botanical origin remained unknown. But the plant from which it is derived has recently flowered and fruited at Moscow, and has been named by M. Kauffman, Euryangium Sumbul, N. O. Umbelliferæ.

*Characters.*—The root is at once characterised by its musky odour, and its porous, fibrous appearance, somewhat like compressed sponge. No definite active principle has been isolated from it, and its most important constituents seem to be two oleo-

resins, one soluble in alcohol, the other in ether. These contain angelic acid,  $C_5H_8O_2$ , along with valerianic acid.

*In Medicine.*—It was first employed in Europe by Russian physicians, and its chief properties seem to be those of a nervous stimulant and antispasmodic, somewhat similar to those of valerian. It has been specially recommended in low fevers, dysentery, delirium tremens, spasmodic and hysterical affections. The Tincture may be given in 3 ss. doses; the resin of sumbul has also been administered in doses of 1 or 2 grs. (Murawieff).

### SUPPOSITORIA.\*

Suppositories are small, medicated, solid masses, intended to be introduced into the rectum. Their form may be cylindrical, conical, or spherical, and they are inserted by the finger or by a little instrument, devised for the purpose. Three fatty substances formed the basis of the suppositories, British Pharmacopœia, 1867, viz., benzoated lard, white wax, and oil of theobroma (cacao butter); but in the Additions, British Pharmacopœia, 1867, curd soap and starch are adopted as the vehicle. By this combination a proper consistence is secured, and any tendency to rancidity is obviated. Suppositories fulfil much the same purposes as enemata, and are sometimes preferable from their small bulk and facility of application. They are employed (*a*) as astringents, e. g. Suppos. Ac. Tann.; (*b*) as anodynes and narcotics, e. g. Suppos. Morphicæ; (*c*) as sedative astringents, e. g. Suppos. Plumbi Co.; (*d*) to secure the specific action of a remedy on the system, e. g. Suppos. Hydrargyri; (*e*) as purgatives; for example, a cylinder or cone of common soap about as thick as a small candle will succeed admirably as a means of evacuating the rectum.

Each of the officinal suppositories is intended to weigh about 15 grs.

\* *Sub*, under; *pono*, to place.

## SUPPOSITORIA ACIDI CARBOLICI CUM SAPONE.

One gr. of carbolic acid in each. May be used in ulcers and fissures of the rectum.

## SUPPOSITORIA ACIDI TANNICI.

Three grs. of tannic acid in each. Especially applicable to piles, prolapsus of rectum from relaxation, &c.

## SUPPOSITORIA ACIDI TANNICI CUM SAPONE.

A better formula than the preceding one, for it does not melt so readily.

## SUPPOSITORIA HYDRARGYRI.

Five grs. of Ung. Hydrarg. in each, i. e.  $2\frac{1}{2}$  grs. of mercury. Applicable in cases where the stomach is irritable.

## SUPPOSITORIA MORPHIÆ.

Each contains gr. ss. of hydrochlorate of morphia; i. e. double the strength of those in the edition of 1864.

An excellent remedy in strangury, tenesmus, and indeed in all irritative diseases of the pelvic viscera. It may also be used with advantage in cases of obstinate vomiting, and to produce the general effects of opium upon the system whenever the administration of opiates by the mouth is contra-indicated.

## SUPPOSITORIA MORPHIÆ CUM SAPONE.

Same strength as the preceding formula, which it is presumably intended to supersede.

## SUPPOSITORIA PLUMBI COMPOSITA.

Contains 3 grs. of acetate of lead, and 1 gr. of opium, in each.

An excellent astringent and anodyne in painful affections of the rectum, in hemorrhage, and diarrhœa.

*SYRUPI.*

Medicated syrups are aqueous solutions of sugar, charged with one or more medicinal substances. The two chief objects of the preparation of syrups are: 1. Conservation of medicinal substances in a convenient form; 2. A desirable mode of administration of acrid or repulsive drugs. Of the eighteen officinal syrups, all are derived from the vegetable kingdom, except the syrups of the iodide and phosphate of iron, and the syrup of chloral. They are prepared by simply adding the proper quantity of sugar to the vegetable solution, and in some cases a little spirit is added, either to aid in the extraction of the active principles, or to preserve the syrup from decomposition. The best refined sugar should be employed, and the average proportion is about two parts of sugar to one of the liquid, i. e. from 2 to  $2\frac{1}{2}$  lbs. in Oi. If the quantity of sugar be too small, fermentation is apt to occur; if too abundant, crystallisation.

The sp. gr. of most of the syrups is about 1.33 and upwards.

The syrups are liable to undergo various alterations in course of time. Thus, they are apt to ferment in warm weather; and in syrups containing acid, the cane sugar is sometimes converted

slowly into glucose (grape sugar), which, being less soluble, is deposited in crystalline grains.

There are two tonic (iron) syrups; three purgatives, viz., Syr. Rhamni, Rhei, Sennæ; one expectorant and emetic, Syr. Scillæ; one feeble narcotic, Syr. Papav.; one hypnotic, Syr. Chloral; the remaining ten have no medicinal activity, and are used chiefly or exclusively for colouring and flavouring mixtures.

## SYRUPUS.

Simple syrup, when properly prepared, is inodorous, nearly colourless, and perfectly transparent. Seven measures of syrup contain six of sugar. If turbid and coloured, it may be clarified by boiling it with white of egg and a little animal charcoal.

*In Pharmacy.*—Syrup is useful in the preparation of various confections and pills, and is often employed in mixtures to suspend insoluble powders, e. g. Mist. Cretæ, and to form emulsions with oily and resinous bodies.

## SYRUPUS AURANTII.

### SYRUPUS AURANTII FLORIS.

Employed solely on account of their agreeable flavour. Oil of Neroli, i. e. orange flower oil, contains a fragrant hydrocarbon,  $C_{10}H_{16}$ , colourless when fresh, but becoming red on exposure to light.

## SYRUPUS CHLORAL.

An aqueous solution of chloral, flavoured with simple syrup. It contains 10 grs. in 3i.

## SYRUPUS FERRI IODIDI.

The preparation of this compound is exactly the same as that already described under Ferri Iodidum, viz., direct combination



of iron and iodine. A considerable excess of metallic iron is used. The ferrous iodide, which is a salt very prone to oxidation, is preserved from decomposition by the syrup, a plan originated by Frederking of Riga, in 1839.

*Characters.*—Pure well made syrup of iodide of iron is a transparent liquid, with a tinge of green. It should exhibit no brown sediment of peroxide of iron, and should not contain any free iodine. If badly prepared, and especially if kept in bottles partly filled and frequently opened, it is very liable to absorb oxygen and undergo decomposition, but if well made, it will keep for 20 years without material change. Exposure to bright sunlight will bleach the syrup when slightly discoloured.

Several means have been proposed to aid its preservation, but the cause of failure probably lies in faulty or careless preparation, and in some cases may be due to the sugar being inferior in quality or insufficient in quantity.

The average dose is 3 ss. (see p. 321).

## SYRUPUS FERRI PHOSPHATIS.

*Preparation.*—Originally introduced by Mr. Greenish. The first part of this process is almost identical with that for Ferri Phosphas, under which head the reactions that occur are explained (see p. 327). The difference in this preparation is that, after the insoluble ferrous phosphate is prepared, instead of being dried, it is pressed between blotting paper, then dissolved in diluted phosphoric acid, and made into a syrup with sugar.

The sugar fulfils the same office as in the preceding preparation, viz., to prevent oxidation. The syrup sometimes becomes gradually brown, owing probably to the formation of caramel; it generally arises however from the phosphate, owing to imperfect washing, retaining small quantities of acetic

acid, whereby red ferric acetate is developed which colours the solution.

For its uses, see Ferri Phosphas.

### SYRUPUS HEMIDESMI.

Of no importance save for communicating an agreeable flavour to mixtures.

Often known as *syrup of smilax*, because hemidesmus root was formerly confounded with the root of *Smilax aspera*.

### SYRUPUS LIMONIS.

This syrup forms a grateful and cooling addition to mixtures and draughts.

### SYRUPUS MORI.

Used only to colour and flavour mixtures, but its tinctorial power is feeble.

### SYRUPUS PAPAVERIS.

In its preparation spirit is used to precipitate albuminous matter which would tend to its putrefaction.

A very feeble anodyne and narcotic preparation, open to the objection that the amount of morphia in it is variable.

Recommended in infantile cases to allay pain and restlessness, relieve cough, and procure sleep, but its use should be discountenanced. A spurious syrup is sometimes made by adding tincture or extract of opium to simple syrup.

### SYRUPUS RHAMNI.

An active hydragogue cathartic in doses of ʒi. or ʒij. It is apt to crystallise on keeping.

## SYRUPUS RHEI.

A mild aperient preparation, suitable for children.

## SYRUPUS RHŒADOS.

This syrup is very apt to ferment, and its sole recommendation is its red colour. But its colouring power is feeble, and the syrup is worthless medicinally.

## SYRUPUS ROSÆ GALLICÆ.

Used like the last syrup to colour mixtures. Possesses feeble colouring and astringent qualities.

## SYRUPUS SCILLÆ.

A favourite and useful expectorant preparation, and suitable for young children as an emetic.

## SYRUPUS SENNÆ.

A very agreeable preparation of senna, the flavour of which is almost completely masked by the coriander. It was proposed by Mr. Squire.

As in the Syr. Papaveris, fermentation is avoided by first coagulating the albuminous matter by spirit.

## SYRUPUS TOLUTANUS.

A preparation of little value only capable of imparting an agreeable flavour to mixtures.

## SYRUPUS ZINGIBERIS.

A warm stomachic preparation, which may be usefully added to tonic and purgative prescriptions.

## TABACI FOLIA.

*Origin.*—Several varieties of tobacco are cultivated, but the only species recognised in the British Pharmacopœia, or the United States Pharmacopœia, is *Nicotiana Tabacum*,\* N. O. Solanaceæ. Virginia is the region of North America which is most celebrated for its culture.

*Characters.*—The dried leaves are distinguished by their brown colour, heavy odour, and large size. The lowermost leaves are often two feet long by six inches broad. The active principle of tobacco, which does not occur in the seeds, is nicotia, a pale yellow volatile liquid alkaloid, combined with malic and citric acids. Like other volatile alkaloids, nicotia is destitute of oxygen, and its formula is  $C_{10}H_{14}N_2$ , or probably  $(C_5H_7)_2''N_2$ , for all the natural alkaloids are either secondary or tertiary amines. Nicotia is liberated by distillation with the fixed base potash, and is characterised by its peculiar odour, by its solubility in water as well as in ether, and by giving a light yellow precipitate with  $PtCl_4$ . In the latter respect, as also in yielding a precipitate with  $AuCl_3$ , it differs from conia, the volatile base of hemlock, and the alkaloid with which nicotia is most liable to be confounded.

Unlike conia, nicotia is remarkably stable even in contact with putrefying animal matter, and resists change to an extreme degree. Traces of it have been found in the blood of a rabbit killed by one drop.

The quantity of nicotia varies greatly, from 1 or 2% to 7% or more.

Since the leaves undergo considerable chemical changes during the processes of curing and preparation for use, the British

\* From Nicot, French Ambassador at the Court of Lisbon, who introduced it into France in 1560. *Tabacum*, from the island of Tobago, where it was first found.

Pharmacopœia directs that tobacco for medical use should be “not manufactured.”

*In Medicine.*—The local irritant effects of tobacco and its influence in promoting secretion are familiarly illustrated in the practices of taking snuff, chewing tobacco, and smoking.

When smoked or taken internally, its chief operation is exerted on the nervous system primarily, and secondarily on the vascular system. Thus, in moderate quantities, especially in those habituated to its use, it acts as a gentle sedative, calms mental and bodily restlessness, and induces a comfortable state of repose. Very extensive observation has shown that the habitual practice of smoking in moderation is not attended, in healthy adults, with any ill effects, such as those alleged by the uncompromising opponents of tobacco.

In larger quantities it produces headache, vertigo, faintness, purging, nausea, distressing vomiting, dimness of sight and alarming prostration, with great feebleness of the pulse, tremors, and a cold skin. Locally applied to the conjunctiva, nicotia causes myosis, which also frequently occurs from its internal administration.

Nicotia is one of the most violent poisons, and is about 16 times as energetic as conia. It exerts its deadly influence upon all classes of animals, although some species resist it more than others. Thus, a goat has eaten 1 oz. of shag tobacco without any perceptible effect following, and 10m. of nicotia subcutaneously injected into the same animal, merely caused temporary loss of power over the limbs.

As a remedial agent, tobacco is now principally used in the treatment of spasmodic affections.

For example, in tetanus or in strychnia poisoning, great relief is afforded and cures have been effected by the administration of a tobacco enema, or by the application of the moistened leaves to the skin. Even in the latter case, caution should be observed lest unpleasant effects follow through absorption.

In spasmodic asthma the relief given in the height of the par-

oxysm is often astonishing, and in the difficult expectoration of chronic asthmatic bronchitis, tobacco will sometimes promote the expulsion of viscid mucus better than any other means, and free the patient from the overbearing sense of oppression on the chest. Should the tobacco enema of the B. P. be prescribed, it is safer not to employ more than half the quantity (i. e. 10 grs. of tobacco) at one time, for a tobacco enema has more than once occasioned death. Infusion of tobacco is sometimes used to allay troublesome itching, and to destroy vermin on the skin, but even in this form, poisonous effects may follow. Dr. Copland mentions a case in which 30 grs. taken in infusion proved fatal. The dose of nicotia internally is from  $\frac{1}{4}$  to  $\frac{1}{2}$  minim.

### TAMARINDUS.\*

*Origin.*—The *Tamarindus Indica*, N. O. Leguminosæ, is a tree of large size, bearing yellow flowers beautifully variegated with red veins. The fruit a broad, reddish pod, with a fragile shell, and contains numerous quadrangular seeds, each in a membranous cell, and imbedded in pulpy matter, between which and the shell are several tough, woody strings. Tamarind pulp is prepared for exportation by placing the pods, previously deprived of their shells, in layers in a cask, and pouring boiling syrup over them.

*Characters and Tests.*—The acid flavour of the pulp is chiefly due to citric acid (nearly 10%), besides which it contains tartaric and malic acids, and cream of tartar. Tamarind pulp is occasionally prepared in copper boilers, and the presence of that metal is detected by the red deposit of copper which gradually forms on a piece of bright iron immersed in the pulp.

*In Medicine.*—A mild refrigerant laxative, and it forms one of the ingredients of Conf. Sennæ.

\* Tamari Hindi, *Hindustani*; signifying, Indian date.



## TARAXACI RADIX.

*Origin.*—The characters of the common dandelion, *Taraxacum*\* *Dens Leonis*, N. O. *Compositæ*, are too well known to need any description, and it is sufficient to mention that all parts of the plant contain a milky, bitter juice, which is most abundant in autumn and winter, the proper period for collecting the root. The juice of the root is thin and watery in the spring.

*Characters and Tests.*—The fresh, full grown root of the dandelion is long, tapering, and smooth externally, but in the dried state, it is dark brown, wrinkled, and brittle.

The roots of various other *Composites* have often been substituted for dandelion. If any leaves be adherent to them, those of the true dandelion are known by their large runcinate (i. e. points turned downwards) teeth, and smooth surface: moreover, a transverse section of the root presents a number of irregularly concentric rings.

*In Medicine.*—A mild tonic aperient, and has been supposed to have a specific action on the liver, but its value seems to be doubtful, and its virtues have been much exaggerated. The result of the experiments made in 1869 by the Edinburgh Committee of the Brit. Med. Assoc. was, that in dogs, the solid extract of *taraxacum*, in doses varying from 60 to 240 grains, affected neither the biliary secretion, the bowels, nor the general health.

## TEREBINTHINA CANADENSIS.

*Origin.*—The origin and general characters of the varieties of turpentine have been already described under *Oleum Terebinthinæ*, p. 498, and it will be sufficient here to give a list of the coniferous trees which are mentioned in the B. P. as yielding

\* *Ταράσσω*, to change; from its supposed alterative effect on the blood.

turpentine or allied products. But it is to be understood that various other species of fir and pine contribute to furnish some of the stock introduced into commerce.

<i>Abies balsamea</i> (Balm of Gilead fir).	<i>Terebinthina Canadensis</i> .
<i>Abies excelsa</i> (Spruce fir).	<i>Pix Burgundica</i> .
<i>Pinis sylvestris</i> (Scotch fir).	} <i>Pix liquida</i> .
,, <i>palustris</i> (Swamp pine).	
,, <i>palustris</i>	} <i>Thus Americanum</i> .
,, <i>Tæda</i> ( <i>Frankincense</i> pine).	
,, <i>Tæda</i> .	} <i>Oleum Terebinthinæ</i> ; <i>Resina</i> .
,, <i>palustris</i> .	
,, <i>Pinaster</i> ( <i>P. maritima</i> ), or (Bordeaux pine).	

The bark of the Larch, *Larix Europæa*, has been recently introduced into the Pharmacopœia.

*Characters*.—Canadian turpentine is often called Canada balsam, but incorrectly so, for it contains no benzoic or cinnamic acid. It yields on distillation about 18% of volatile oil, the residue being chiefly resin. Like copaiba, it slowly solidifies when mixed with a little magnesia, owing to the formation of a firm magnesian soap. The finer kinds are sometimes sold as true Balm of Gilead, which however is produced by *Balsamodendron opobalsamum* (Guibourt).

*In Pharmacy*.—Employed to give a proper consistence to *Charta Epispastica* and *Collodium Flexile*.

*In Medicine*.—This form of turpentine is scarcely ever employed internally, although it possesses the stimulant qualities found throughout this class of medicines, and has been recommended in chronic mucous discharges.

It is much used in the mounting of specimens for the microscope, in the cementing of optical glasses, and in the preparation of varnishes.

## THERIACA.\*

*Origin.*—Treacle, or molasses, is the impure dark brown liquid obtained in refining cane sugar, and results chiefly from the application of heat in evaporating the syrup.

*Characters and Tests.*—Treacle essentially consists of more or less cane sugar ( $C_{12}H_{22}O_{11}$ ) which has escaped separation in the process of refining, mixed with uncrystallisable (inverted sugar,  $C_6H_{12}O_6$ ), gum, and colouring matter. If too high a heat have been employed in the sugar refining, the treacle will have a disagreeable odour and taste.

*In Pharmacy.*—Used in the formation of pills, for which it is well fitted, on account of its retentiveness of moisture and its antiseptic qualities, and it is often employed as a cheap substitute for pure syrup. Diluted treacle, when fermented and distilled, yields rum.

The term *theriaca* was also formerly applied to a complex medley of drugs, the vestige of which remains in the *Confectio Opii*.

## THUS† AMERICANUM.

*Origin.*—Frankincense or the common American turpentine is derived from the extensive pine forests, *Pinus Tæda* and *P. palustris*, of the States of North America. European *Thus* is derived from *Abies excelsa*, and when melted and strained, constitutes *Pix Burgundica*.

It is procured by making excavations into the stem of the tree near the ground into which the juice gradually flows and solidifies. From the tree the exudation is transferred to casks, where it slowly thickens and ultimately acquires a soft, solid consistence.

\* *Θῆρ*, a wild animal; because used as an antidote.

† *Θύω*, to sacrifice; from its former use.

*Characters.*—Distinguished by its yellow colour, and slightly aromatic odour. Exposed to the air, it finally becomes perfectly hard and dry. In the recent state it affords about 17% of volatile oil on distillation.

*In Pharmacy*—Used only in the preparation of Empl. Picis.

### *TINCTURÆ.\**

Tinctures are alcoholic solutions of medicinal substances, prepared without the aid of heat. The spirits and essences differ from tinctures only in being alcoholic solutions of volatile oils of definite strength, and there is no positive demarcation between these groups.

(1). *Solvents.*—In no instance is absolute alcohol employed, and the different varieties of spirit used as solvents, are:—

(a.) Simple rectified spirit, . . .	24
(b.) Spirit of ether, . . . . .	1
(c.) Aromatic spirit of ammonia	2
(d.) Simple proof spirit, . . .	40
(e.) Tincture of orange peel, .	1
	68.

But as spirit of ether and aromatic spirit of ammonia are prepared with rectified spirit, and tincture of orange peel with proof spirit, it may be said that—

Tinctures made with rectified spirit, .	27
Tinctures made with proof spirit, . .	41

68.

Diluted alcohol or proof spirit is used in the majority of cases, not only as being cheaper and less stimulating, but also because

\* *Tingo*, to dye; from their various colours.

it is strong enough, in most instances, to extract the active qualities of the plant and to preserve the product from decomposition. But rectified spirit is required as the solvent whenever the substance to be extracted or dissolved is difficultly soluble or insoluble in water, e. g. resins (Tr. Cannabis Ind.), volatile oils (Tr. Lavand. Co.), or gum resins containing but little gum (e. g. Tr. Assaf.).

(2). *Preparation and Origin.*—The methods followed in their preparation are three—

(a.) Direct solution or mixture ; all prepared with rectified spirit, . . . . .	7
(b.) Maceration for seven days (or, in one case for three days), . . . . .	20
(c.) Maceration for two days, followed by perco- lation, . . . . .	41
	<hr/> 68.

Process (a.) is preferred as the simplest in preparing the inorganic tinctures (e. g. Tr. Iodi.), or solutions of highly resinous bodies (e. g. Tr. Cann. Ind.), i. e. bodies which are readily and at once soluble in alcohol.

(b.) Is preferred in the cases of substances containing a considerable amount of resinous or oily material, and

(c.) Is selected in the preparation of tinctures from the fibrous and dry parts of plants, e. g. roots, barks, leaves, &c.

With regard to their origin, all the Tinctures are derived from the vegetable kingdom (i. e. 61), except three from animal substances (Tr. Canthar., Castorei, Cocci), and four from inorganic bodies] (e. g. Tr. Chlorof. Co., Tr. Ferri Acet., Tr. Ferri Perchlor., and Tr. Iodi.).



17 Tinctures are obtained from roots and underground stems.

15 from the flower, fruit, or seed.

13 from products of plants, i. e. gum resins, balsams, extracts, &c.

10 from stems and barks.

6 from leaves.

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61.

(3). *General Characters*.—The general appearance and properties of tinctures differ considerably, and their colour varies from very pale yellow, through every shade to dark red and opaque brown.

More than half of them (viz. 34) have a common strength, i. e.  $2\frac{1}{2}$  oz. of the drug to Oi. of spirit, or one part in eight. In the case of 7, the strength is one in ten, viz., Tinct. Chlorof. Co., Tr. Benz. Co., Tr. Kino, Tr. Aurantii, Tr. Nucis Vom., Tr. Cinch. Co., Tr. Rhei. The remainder vary in strength from 1 in 213 (Tr. Lavand. Co.) to 1 in 2 (Tr. Zingib. Fortior).

Twelve tinctures are now included which were not in the 1864 edition of the Pharmacopœia.

(4). *Classification*.—Since the gradations in colour of the tinctures are so various according to the nature of the drug, its quality, and the method of preparation employed, it is impossible to adopt colour as a basis of classification. Neither are the odour and taste characteristic, except in comparatively few instances; but by the help of a simple principle, viz., the behaviour of tinctures when diluted with water, it is possible to throw the tinctures into three primary groups, and even to distinguish the individual tinctures in each group by this relation, aided by the subordinate characters of colour, odour, taste, and chemical reactions.

All the tinctures in the Pharmacopœia are comprised in three classes :—



## CLASS I.

Tinctures which, when diluted with seven volumes of distilled water, remain clear and transparent. 39 in number.

## CLASS II.

Tinctures which, when diluted with seven volumes of distilled water, become opalescent by *transmitted* light. 14 in number.

## CLASS III.

Tinctures which, when diluted with seven volumes of distilled water, become more or less turbid or opaque. 15 in number.

The fact of tinctures remaining clear on dilution, indicates in general the absence of any notable quantity of resin, essential oil, or other matter insoluble in water.

By opalescence is meant that milky or blueish tint which some tinctures assume on dilution when viewed by transmitted light, without at the same time losing their transparency.

Many tinctures, after dilution with distilled water, are clear and transparent when viewed by transmitted light, but when regarded by reflected light, appear opalescent, or in some cases, almost opaque.

(5). *In Pharmacy.* Tinctures are sometimes used as vehicles for other medicines, e.g. T. Aurantii or T. Limonis is a good solvent for creasote.

(6). *In Medicine.*—As therapeutic agents, tinctures are usually employed as adjuvants in combination with other remedies, and often for the purpose merely of colouring or agreeably flavouring a prescription. Chiefly for the latter purpose are used, Tr. Aurantii; Tr. Card. Co.; Tr. Cinnam; Tr. Cocci; Tr.

Croci; Tr. Lavand. Co.; Tr. Limonis; Tr. Tolutana; Tr. Zingiberis.

Some are given *per se*, or simply diluted with water, and a few are so potent that they require to be administered with caution even in small doses. Tinctures are not suitable forms for medicines which must be prescribed in large doses, because in that case the effects of the alcohol come into serious consideration, and care should be exercised in their use in chronic cases, lest habits of intemperance be excited.

(7). *Characters of individual Tinctures.*—The colours of the tinctures are described as they appear in clear glass bottles, two inches in diameter. The experiments with dilution in water were performed in test tubes  $\frac{1}{2}$  an inch in diameter: 1 part of the tincture to seven parts of distilled water. The chemical reagents were added to the undiluted tinctures in watch glasses.

### TINCTURA ACONITI.

Colour, pale sherry. Taste pungent, after some time a tingling sensation in the lips. When diluted, no change, or a milky opalescence by reflected and transmitted light, which undergoes no alteration on boiling, nor on standing for 24 hours. With  $\text{Fe}_2\text{Cl}_6$ , pale olive green.

Care should be taken not to confound this tincture with Dr. Fleming's tincture of aconite which is about five times as strong.

Tinct. Aconiti is  $\frac{1}{5}$  the strength of Linim. Aconiti.

### TINCTURA ALOES.

Almost opaque, like porter. Taste sweetish, owing to the liquorice, subsequently bitter.

When diluted, remains clear and transparent. With  $\text{Fe}_2\text{Cl}_6$ , a pale nut brown precipitate. The liquorice only partially covers

the disagreeable bitter taste of the aloes. It is said that it sometimes deposits crystals of aloin, and a yellow resinous matter.

### TINCTURA ARNICÆ.

Pale straw colour. Taste pungent. When diluted, remains clear and transparent, or a slight opalescence by reflected light. With  $\text{Fe}_2\text{Cl}_6$ , light green. Slight blue fluorescence. Popularly believed to possess extraordinary powers in relieving bruises, sprains, and local pains, and in promoting the absorption of effused blood, but it is credited with more than it deserves. It seems probable now that neither the irritant substance, *arnicine* (insoluble in water, soluble in alcohol), nor the volatile oil, is the really active ingredient of arnica, but, *trimethylamine*,  $\text{C}_3\text{H}_9\text{N}$ , which is freely soluble in water and in alcohol. Dr. C. D. Phillips maintains that *aqueous* solutions of arnica are undoubtedly useful in external bruises and cuts, and he believes that the local irritant effects which have been occasionally observed to attend the use of arnica lotions, have been caused by their being prepared with the alcoholic tincture.

### TINCTURA ASSAFŒTIDÆ.

Reddish brown. Odour and taste of assafœtida. When diluted, becomes opaque white, and deposits a little yellow resin after 24 hours.

### TINCTURA AURANTII.

Colour, clear sherry. Odour and taste of orange peel. When diluted, a yellow opalescence by reflected and transmitted light. The degree of opalescence varies with the quantity of essential oil in the orange peel, and consequently serves as an efficient and simple test for the quality of the tincture. With

$\text{Fe}_2\text{Cl}_6$ , dark brown. Used to dissolve Quin. Sulph. (Tr. Quin. Sulph.), and it forms a grateful addition to mixtures and draughts.

### TINCTURA AURANTII RECENTIS.

Introduced because, containing more oil, it possesses a more agreeable flavour than the tincture made from the dried peel.

When diluted, slightly opalescent. With  $\text{Fe}_2\text{Cl}_6$ , dark brown.

### TINCTURA BELLADONNÆ.

Colour, dark brown. Odour, nauseous. When diluted, perfectly transparent by reflected and transmitted light. No change after 24 hours. With  $\text{Fe}_2\text{Cl}_6$ , pale olive brown.

### TINCTURA BENZOINI COMPOSITA.

Opaque reddish brown. Tinges bottle yellow. Odour balsamic; taste, sweet and astringent. When diluted, becomes permanently opaque deep yellow. This tincture is the *traumatic balsam* of the older Pharmacopœias, and essentially represents what used to be known as *Friar's balsam* (Wade's balsam; Jesuits' drops).

One variety of *court plaster* is made by brushing over black silk or sarsenet, a solution of isinglass, followed by Tincture of Benzoin.

### TINCTURA BUCHU.

Colour, clear brown. Odour and taste aromatic, like peppermint.

When diluted, remains clear and transparent, or is slightly opalescent, especially by reflected light; after 24 hours no change, but it becomes transparent on boiling. With  $\text{Fe}_2\text{Cl}_6$ , opaque, dark green.

## TINCTURA CALUMBÆ.

Dark sherry coloured. Taste, pure bitter.

When diluted, remains clear and transparent. With  $\text{Fe}_2\text{Cl}_6$ , no change.

## TINCTURA CAMPHORÆ COMPOSITA.

Colour, clear pale sherry. Odour of anise; taste, aromatic and sweet.

When diluted, semi-opaque by reflected and transmitted light. No change after 24 hours. With  $\text{Fe}_2\text{Cl}_6$ , gives an opaque, red buff colour (benzoate and meconate of iron).\*

Well known as (English) paregoric elixir. It contains 2 grs. of opium in  $\text{℥i.}$ , and is in frequent use as an anodyne and anti-spasmodic. "Powell's balsam of aniseed," is an imitation of this tincture.

## TINCTURA CANNABIS INDICÆ.

Opaque green; tinges bottle dark olive. Taste, sharp and bitter. When diluted, becomes permanently opaque pale olive green. With  $\text{Fe}_2\text{Cl}_6$ , dusky sap green. Differs from other tinctures in not being prepared directly from the plant; it is simply a solution of the resinous extract in rectified spirit.

## TINCTURA CANTHARIDIS.

Pale straw yellow. When diluted, remains clear and transparent. With  $\text{Fe}_2\text{Cl}_6$ , no change. Blue fluorescence. With KHO no change, and it is thus distinguished from Tr. Scillæ, which otherwise it closely resembles.

\* Stellate crystals when dry.

A very weak preparation, for 3i. represents only  $\frac{3}{4}$  gr. of cantharides.

When long kept, it is said to deposit crystals of cantharidin, with fatty and other matters.

### TINCTURA CAPSICI.

Straw colour. Taste, burning hot. When diluted, transparent or slightly opalescent by reflected and transmitted light, and it exhibits light blue fluorescence. With  $\text{Fe}_2\text{Cl}_6$ , no change.

### TINCTURA CARDAMOMI COMPOSITA.

Clear dark red. Odour of cinnamon. Taste, aromatic, like caraway.

When diluted, remains clear and transparent. With  $\text{Fe}_2\text{Cl}_6$ , pale dull green. A very agreeable aromatic tincture.

### TINCTURA CASCARILLÆ.

Colour, dark brown. Odour, aromatic, like marjoram. Taste, aromatic bitter.

When diluted, yellow opalescence by transmitted light, semi-opaque by reflected light. No change on boiling, nor after 24 hours. With  $\text{Fe}_2\text{Cl}_6$ , light olive.

### TINCTURA CASTOREI.

Bright red brown. Odour peculiar and heavy. Taste, slightly bitter. When diluted, becomes pale fawn colour, and permanently opaque. With  $\text{Fe}_2\text{Cl}_6$ , greenish black.

Deposits a yellow substance when long kept.



## TINCTURA CATECHU.

Colour, opaque, reddish brown; taste astringent. When diluted, opaque, deep chocolate. No change after 24 hours.\* With  $\text{Fe}_2\text{Cl}_6$ , opaque, dark brown.

Leaves on evaporation an opaque *brick red* residue. If made from the Catechu nigrum of commerce, it leaves a *transparent brown* residue.

It sometimes gelatinises when kept, and should in that case be rejected from use.

## TINCTURA CHIRATÆ.

Colour, clear hyacinth brown. Taste, intense bitter. When diluted, limpid, pale sherry colour by reflected and transmitted light. No change on boiling, nor after 24 hours. With  $\text{Fe}_2\text{Cl}_6$ , dark olive.

## TINCTURA CHLOROFORMI COMPOSITA.

Colour, bright ruby red. Odour of chloroform. Taste, sweet and subsequently aromatic. When diluted, becomes turbid, pale brick red. After some time about  $\frac{2}{3}$  of the chloroform settle at the bottom of the tube; supernatant fluid, transparent pink. With  $\text{Fe}_2\text{Cl}_6$ , dark green.

## TINCTURA CINCHONÆ COMPOSITA.

Dark red brown; tinges bottle reddish yellow. Odour slightly aromatic. Taste, aromatic and bitter. When diluted,

\* Some specimens when diluted, become transparent deep garnet red by transmitted light, opaque by reflected light.

becomes turbid pale brick red ; some flocks gradually subside, and are redissolved by heat, but turbidity returns on cooling. With  $\text{Fe}_2\text{Cl}_6$ , dark olive green.

Sometimes called Huxham's tincture of bark. An excellent stomachic cordial.

### TINCTURA CINCHONÆ FLAVÆ.

Dark reddish brown. Taste, bitter and slightly astringent. When diluted, becomes turbid pale brick red, opaque by reflected light. After 24 hours, a copious brick red precipitate, which redissolves partly on boiling. With  $\text{Fe}_2\text{Cl}_6$ , sap green.

### TINCTURA CINNAMOMI.

Colour, clear garnet red or deep brown. Odour and taste of cinnamon. When diluted, limpid, pale hyacinth brown by reflected and transmitted light. No change after 24 hours, nor on boiling. With  $\text{Fe}_2\text{Cl}_6$ , dark sap green.

### TINCTURA COCCI.

Opaque red. Colours the saliva red. When diluted, remains clear and transparent. With  $\text{Fe}_2\text{Cl}_6$ , black, like Indian ink.

Used only for imparting colour.

### TINCTURA COLCHICI SEMINUM.

Colour, straw yellow or light brown. Taste, somewhat bitter, like rancid almond oil. When diluted, perfectly limpid by reflected and transmitted light. No change on boiling ; slight opalescence by reflected light after 24 hours.

## TINCTURA CONII.

Clear brown. Nauseous odour and taste of hemlock. When diluted, remains clear and transparent. With  $\text{Fe}_2\text{Cl}_6$ , clear dark green, or slight turbidity.

## TINCTURA CROCI.

Orange red, tinges bottle yellow. Odour and taste of saffron. When diluted, remains clear and transparent. With  $\text{Fe}_2\text{Cl}_6$ , bright olive green.

It gradually bleaches on exposure to light.

## TINCTURA CUBEÆ.

Colour, clear sherry. Taste, hot and peppery. When diluted, opaque light buff yellow, or milk white, by transmitted and reflected light. No change on boiling, nor after 24 hours.

## TINCTURA DIGITALIS.

Colour, clear dark brown. Odour and taste sickly. When diluted, transparent by transmitted light, olive yellow opalescence by reflected light. After 24 hours an abundant, flocculent, grey precipitate, which redissolves on boiling. With  $\text{Fe}_2\text{Cl}_6$ , dark olive, flocculent precipitate.

## TINCTURA ERGOTÆ.

Dark reddish brown. When diluted, remains clear and transparent. With  $\text{Fe}_2\text{Cl}_6$ , pale olive brown.

## TINCTURA FERRI ACETATIS.

Colour, opaque, dark brown. Odour, acetous; taste, feebly acid and astringent.

When diluted, remains clear and transparent. See p. 317.

## TINCTURA FERRI PERCHLORIDI.

Colour, clear sherry; tinges bottle greenish yellow. Odour of hydrochloric ether; taste, sharply astringent. When diluted, remains clear and transparent. See p. 323.

## TINCTURA GALLÆ.

Dark reddish brown, nearly opaque. Taste, astringent. When diluted, remains clear and transparent. With  $\text{Fe}_2\text{Cl}_6$ , blueish black.

A powerful astringent, but used more as a test than as a medicine. When long kept, it is said that the tannic acid is completely converted into gallic acid.

## TINCTURA GENTIANÆ COMPOSITA.

Colour, brown sherry. Odour of orange peel. Taste intensely bitter. When diluted, remains clear and transparent, or becomes slightly opalescent. With  $\text{Fe}_2\text{Cl}_6$ , black colour.

## TINCTURA GUAIACI AMMONIATA.

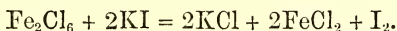
Opaque dark brown. Odour of ammonia. Taste, pungent. When diluted, becomes permanently opaque pale olive brown. With  $\text{Fe}_2\text{Cl}_6$ , dark brown precipitate.

## TINCTURA HYOSCYAMI.

Dark brown. Odour, heavy and sour. When diluted, remains clear and transparent. With  $\text{Fe}_2\text{Cl}_6$ , copious yellow flocculent precipitate.

## TINCTURA IODI.

Opaque, deep red; tinges bottle reddish brown. Odour and taste of iodine. When diluted, transparent, garnet red. With  $\text{Fe}_2\text{Cl}_6$ , no change except some flocks of iodine which separate after a short time—



This, the third solution of free iodine, is  $\frac{1}{3}$  the strength of the Liniment, and about  $\frac{1}{2}$  the Liquor Iodi. The Liquor Iodi might in all cases replace the tincture. After a time some hydriodic acid is formed. The KI is added to prevent the precipitation of the iodine when the tincture is diluted with water, because iodine is soluble in an aqueous solution of iodide of potassium, but the amount of iodide present is not sufficient to prevent partial separation of the iodine when the tincture is diluted with five or six parts of water. The so called “colourless tincture of iodine” is misnamed, for there can be no such thing as a colourless solution of *free* iodine.

## TINCTURA JALAPÆ.

Colour, deep brown. No distinctive odour or taste. When diluted, opaque buff yellow by reflected and transmitted light, and the precipitate slowly subsides in part. No change on boiling, except that the precipitate fuses into a brown resinous globule.

## TINCTURA KINO.

Opaque dark reddish brown. Taste, astringent. When diluted, transparent garnet red. No change after 24 hours. With  $\text{Fe}_2\text{Cl}_6$  opaque dark brown. Lustrous, red, flaky film when dry.

When kept for some time, it undergoes a curious change, hitherto unexplained; it is apt to gelatinise, forms a mass like black currant jelly, and loses its astringency. The jelly is not redissolved by heat or by rectified spirit.

## TINCTURA KRAMERIÆ.

Colour, opaque reddish brown. Taste, astringent. When diluted, clear garnet red by transmitted light, opaque chocolate brown by reflected light. Some specimens on dilution become rich chocolate brown, and permanently opaque. With  $\text{Fe}_2\text{Cl}_6$ , dark sepia. No change after 24 hours; on boiling, it becomes more transparent, and assumes a bright garnet colour, and on cooling is perfectly opaque to transmitted light. Evaporated in a watch-glass, it leaves an opaque brick red deposit.

## TINCTURA LARICIS.

Colour, dark carmine red. Odour, terebinthinate. Taste, styptic and resinous. When diluted, opalescent, light chocolate. With  $\text{Fe}_2\text{Cl}_6$ , dark brown.

## TINCTURA LAVANDULÆ COMPOSITA.

Clear dark crimson red. Odour of lavender. Taste, aromatic and pungent. When diluted, opalescent by transmitted light, opaque deep brick red by reflected light. Some specimens remain clear and transparent. No change after 24 hours. With  $\text{Fe}_2\text{Cl}_6$ , deep red, opaque. Iridescent film left after evaporation.



Its former name of Spir. Lavand. Co. was more appropriate, since it is prepared directly from essential oils.

### TINCTURA LIMONIS.

Colour, pale sherry. Odour and taste of lemon peel. When diluted, greenish opalescence by reflected and transmitted light. No change after 24 hours. A good solvent for creasote.

With  $\text{Fe}_2\text{Cl}_6$ , clear brown.

### TINCTURA LOBELIÆ.

Clear brown. Taste slightly acrid. When diluted, opalescent.

With  $\text{Fe}_2\text{Cl}_6$ , pale olive green.

### TINCTURA LOBELIÆ ÆTHEREA.

Clear olive green. Odour and taste of ether. Deposits gradually a number of small white globules, and becomes amber coloured. When diluted, remains clear and transparent.

By evaporation of the ether, this tincture may become dangerously concentrated.

It is a needless preparation in the presence of the last tincture.

### TINCTURA LUPULI.

Clear red. Odour, nauseous; taste, bitter. When diluted, becomes permanently opaque yellow. Rendered transparent, or nearly so, by boiling, but the turbidity reappears on cooling. Inferior specimens remain clear on dilution, owing to absence of lupulin. With  $\text{Fe}_2\text{Cl}_6$ , rich dark brown.

A Tincture of Lupulin (U. S.) would be preferable, as being stronger and more uniform in quality.

## TINCTURA MYRRHÆ.

Colour, light brown; odour, aromatic; taste, warm and bitter. When diluted, yellowish white or opaque yellow, by transmitted light. No change on standing. Notwithstanding the large proportion of gum in myrrh, rectified spirit is used in making the tincture, because the volatile oil and resin are its active constituents.

## TINCTURA NUCIS VOMICÆ.

Colour, pale sherry. Taste, intensely bitter. When diluted, remains clear and transparent, or becomes slightly opalescent. With  $\text{Fe}_2\text{Cl}_6$ , pale sap green. Slight blue fluorescence.

## TINCTURA OPII.

Colour, dark red brown; odour, opiate; taste, nauseous, bitter. When diluted, a slight brown opalescence, especially by reflected light, or it remains clear and transparent. After 24 hours, a bulky, flocculent, reddish brown precipitate, which redissolves on boiling. With  $\text{Fe}_2\text{Cl}_6$ , red brown.

The proportion of opium in laudanum (*laude dignum*) is 4 grs. to 3i., i. e. sixteen times as strong as paregoric elixir, Tr. Camph. Co. But the opium is not always thoroughly exhausted by the spirit, and in this case 3i. of laudanum would correspond to less than 4 grs. of opium. If opiates are administered to young children, this or one of the other tinctures is preferable, on account of greater uniformity in strength, to the variable and uncertain Syr. Papaveris. 25m. = 22m. of either Extr. Opii Liq. or Vinum Opii.

## TINCTURA OPII AMMONIATA.

Dark red brown; tinges bottle greenish yellow; odour of ammonia. The strong solution of ammonia holds the morphia in solution; carbonate of ammonia would precipitate it. Taste, bitter, pungent, and aromatic. When diluted, opaque greenish yellow by reflected light. No change on standing. With  $\text{Fe}_2\text{Cl}_6$ , brown precipitate of ferric oxide. Acicular crystals form on drying. It is sometimes termed Scotch paregoric.

## TINCTURA PYRETHRI.

Pale amber. Taste, tingling after a few moments, like aconite. When diluted, becomes milky, especially by reflected light.

With  $\text{Fe}_2\text{Cl}_6$ , clear sap green.

## TINCTURA QUASSIÆ.

Straw yellow; becomes colourless by exposure to light. Taste, intensely bitter, but the bitterness is destroyed by the addition of a little permanganate of potassium. When diluted, remains perfectly clear. With  $\text{Fe}_2\text{Cl}_6$ , no change.

## TINCTURA QUININÆ.

Colour, dark sherry. Odour of orange peel. Taste, intensely bitter. When diluted, yellowish, nearly opaque; yellow flocks deposited on standing. With  $\text{Fe}_2\text{Cl}_6$ , clear dark brown.

Contains 8 grs. of Quiniæ Sulph. in  $\text{℥i.}$ , and is eight times as strong as Vinum Quiniæ.

## TINCTURA QUINIÆ AMMONIATA.

A colourless solution. Contains 8 grs. of Quiniæ Sulphas in  $\bar{z}$ i. The sulphate of quinia is decomposed by part of the ammonia, and the solution contains an alcoholic solution of the alkaloid, quinia, together with sulphate of ammonium, and free ammonia. Quinia is soluble in excess of ammonia. When diluted, opaque white. With  $\text{Fe}_2\text{Cl}_6$ , orange brown precipitate.

## TINCTURA RHEI.

Opaque dark brown; tinges bottle yellow; odour, nauseous; taste, aromatic and bitter. When diluted, remains clear and transparent. With  $\text{Fe}_2\text{Cl}_6$ , deep sap green.

## TINCTURA SABINÆ.

Colour, clear dark sherry. Taste, slightly acrid. When diluted, slightly opalescent by reflected light. With  $\text{Fe}_2\text{Cl}_6$ , dark olive green.

## TINCTURA SCILLÆ.

Clear straw yellow. Taste, slightly acrid. When diluted, remains clear and transparent. KHO causes a white precipitate, soluble in excess, and it is thus distinguished from Tinctura Cantharidis, which, in general characters, it closely resembles. With  $\text{Fe}_2\text{Cl}_6$ , no change. It sometimes deposits a grey, bitter, acrid substance, in silky tufts.

## TINCTURA SENEGÆ.

Colour, light brown sherry. Taste, pungent. When diluted, remains clear and transparent. With  $\text{Fe}_2\text{Cl}_6$ , pale brown.

## TINCTURA SENNÆ.

Opaque, dark brown. Taste, slightly aromatic. When diluted, perfectly transparent, pale olive brown. With  $\text{Fe}_2\text{Cl}_6$ , dark olive. It is said to deposit, on keeping, a yellow laminar sediment, containing starch and calcareous crystals. A warm cordial purgative, often added to cathartic mixtures and draughts. Daffy's elixir is a modification of this tincture.

## TINCTURA SERPENTARIÆ.

Colour, clear sherry. Taste, pungent and bitter. When diluted, transparent, or a greenish yellow opalescence, especially by reflected light. No change after 24 hours, nor on boiling.

## TINCTURA STRAMONII.

Dark brown. Taste sickly, slightly bitter. When diluted, remains clear and transparent. With  $\text{Fe}_2\text{Cl}_6$ , no change.

## TINCTURA SUMBUL.

Colour, pale sherry. Odour musky. Taste bitter, like musk. When diluted, yellowish white opalescent or opaque, by transmitted light. No change on standing. With  $\text{Fe}_2\text{Cl}_6$ , a green precipitate.

## TINCTURA TOLUTANA.

Clear reddish brown. Odour and taste balsamic. When diluted, becomes yellowish white. After 24 hours, deposits a dark brown resin, supernatant fluid like diluted milk. Employed principally as a flavouring ingredient.

## TINCTURA VALERIANÆ.

Clear reddish brown. Odour of valerian. Taste, warm. When diluted, perfectly transparent by transmitted and reflected light. No change after 24 hours. With  $\text{Fe}_2\text{Cl}_6$ , light olive green. It deposits on standing, a black, sticky precipitate.

The recent experiments of Grisar point to valerian oil as possessing a manifest influence in reducing reflex excitability and as an antagonist to poisoning by strychnia.

## TINCTURA VALERIANÆ AMMONIATA.

Dark reddish brown. Odour of ammonia and valerian. Taste, pungent. When diluted, remains clear and transparent. With  $\text{Fe}_2\text{Cl}_6$ , pale golden brown flocculent precipitate. A stimulating antispasmodic.

## TINCTURA VERATRI VIRIDIS.

Clear brown. Taste, like a rancid nut. When diluted, yellow semi-opaque by transmitted light; opaque by reflected light. After 24 hours an abundant flocculent precipitate, which dissolves entirely by heat.

With  $\text{Fe}_2\text{Cl}_6$ , clear pale brown.

## TINCTURA ZINGIBERIS.

Clear light brown. Taste very pungent. When diluted, opalescent or transparent, by transmitted light; like diluted milk by reflected light.

## TINCTURA ZINGIBERIS FORTIOR.

Colour, dark sherry. Taste, very pungent and hot. When diluted, opalescent, or opaque light yellow; scanty yellow deposit on standing. Used in the preparation of Pil. Scamm. Co.



## TRAGACANTHA.\*

*Origin.*—The gummy exudation known as tragacanth seems to be collected from various species of the genus *Astragalus*, N.O. Leguminosæ, which are abundant on the mountains of Asia Minor. The juice either exudes spontaneously during the summer from the stem and branches, hardening as it oozes, or is collected from deep incisions made into the base of the plant, which is a small, spinose shrub, not more than two or three feet in height.

*Characters.*—The gum (“gum dragon”) is easily recognised by its occurrence in horny, laminated flakes, destitute of smell, and with very little taste. It is sometimes met with in curved filaments. It is hard and difficult to powder, and has a sp. gr. of 1.384. When digested with water, it swells considerably, and forms a gelatinous mucilage, but is not wholly soluble, and it is insoluble in alcohol. It is usually considered to be a mixture of a variety of arabin (ordinary gum), and of bassorin (tragacanthin), an insoluble form of gum.

*Tinct. Iodi* communicates a faint violet tinge to the mucilage of tragacanth, whereby it is distinguished from mucilage of gum arabic.

Tragacanth is not a true secretion of the plant, but appears to result from a colloid transformation of the cells of the pith and medullary rays.

*In Pharmacy.*—The mucilage, on account of its great viscosity, is sometimes though rarely employed for the suspension of heavy insoluble powders, e. g. Bismuthi Subnitras.

\* *Τράγος*, a goat, and *ἄκανθα*, a thorn. Sheep and goats are particularly fond of this thorny shrub.

*TROCHISCI.\**

Lozenges are small cakes of sugar and gum medicated with various substances.

They are adapted chiefly for the administration of those medicines which do not require to be given in large quantities and are devoid of any very disagreeable flavour.

Not more than six lozenges are supposed to be taken at any one time. Four new lozenges were added in the edition of B. P. 1867, but it seems unwise to extend beyond narrow limits this group of preparations, which belongs to the province of the confectioner rather than to the apothecary.

They are used principally as astringents, anodynes, expectorants, and antacids.

NAME.	PROPORTION OF ACTIVE INGREDIENT.	USES.
T. Acidi Tann.	$\frac{1}{2}$ gr. in each.	Relaxed sore throat
T. Bismuthi.	2 grs. $\text{BiNO}_3$ in each, and about 5 grs. of earthy carbonates.	Antacid and sedative.
T. Catechu.	1 gr. in each.	Relaxed sore throat.
T. Ferri Redacti.	1 gr. in each.	A mild tonic.
T. Ipecacuanhæ.	$\frac{1}{4}$ gr. in each.	Expectorant.
T. Morphiæ.	$\frac{1}{36}$ gr. in each.	Sedative and anodyne.
T. Morph. et Ipecac.	$\frac{1}{36}$ gr. morphia, $\frac{1}{12}$ gr. of ipecac., in each.	Anodyne expectorant.
T. Opii.	$\frac{1}{10}$ gr. extract of opium in each.	Anodyne and sedative.
T. Pot. Chlor.	5 grs. in each.	Mild stimulant.
T. Sodæ Bicarb.	5 grs. in each.	Antacid.

\* Τρόχος, a wheel.

## ULMI CORTEX.

*Origin*—The characters of the common broad leaved Elm, *Ulmus*\* *campestris*, N.O. *Ulmaceæ*, are sufficiently familiar to every one. The inner bark of its young branches is collected for use.

*Characters*.—Distinguished by its rough, fibrous appearance. It contains about 2 or 3% of tannic acid, of the kind which precipitates ferric salts green; and it imparts to water its mucilaginous (20% mucilage) qualities.

*In Medicine*.—Seldom employed now, and has been specially recommended in chronic scaly skin affections. It is feebly tonic and astringent.

## UNGUENTA.†

Ointments are fatty substances medicated with various drugs, and intended to be applied with or without friction. The term *cerate* was formerly applied to ointments of firmer consistence, containing wax, but has now fallen into disuse.

The fats employed in their preparation are lard, suet, wax, almond oil, and olive oil, and care should be taken that no gritty matter be included.

Many ointments become rancid if long kept, and therefore they should not be prepared in too large quantities. This tendency to rancidity may, to a great extent, be prevented by incorporating with the fat, aromatic substances, especially benzoin or other balsams (see *Adeps Benzoatus*).

\* Quasi, *Ulinus*, from *uliginosus*, moist; because it grows best in damp situations.

† *Unguere*, to anoint.

Ointments are almost exclusively used as purely local applications, but the inunction of Ung. Hydrarg. is frequently employed as a means of inducing the constitutional action of mercury. Altogether, no fewer than seven of the 34 ointments are mercurial; three contain alkaloids (aconitia, atropia, and veratria), the proportion in each of these being 8 grs. to  $\text{ʒi}$ . The ointments of tartar emetic, cantharides, and savine, are powerful irritants.

### UNGUENTUM ACONITIÆ.

An energetic local anodyne. Care must be taken not to apply it to an abraded or ulcerated surface.

Contains 8 grs. to  $\text{ʒi}$ .

### UNGUENTUM ANTIMONII TARTARATI.

Contains 1 part of tartar emetic in 5.

Used as a counter irritant occasionally in chest affections, &c. If a small portion be rubbed into the skin two or three times there will be gradually developed an angry papulo-pustular eruption, each pimple surrounded by a red base. The rash differs much in appearance from the vesicular eruption produced by croton oil, and the incautious use of this ointment may cause gangrenous ulceration.

### UNGUENTUM ATROPIÆ.

A powerful anodyne application, and as in the case of Ung. Aconitiæ, care must be exercised not to bring it in contact with broken surfaces.

Contains 8 grs. to  $\text{ʒi}$ .

## UNGUENTUM BELLADONNÆ.

Often used as an anodyne, but a much more cleanly application is furnished by the Linimentum Belladonnæ.

## UNGUENTUM CADMII IODIDI.

Introduced as a colourless substitute for the yellow iodide of lead ointment. Contains 62 grs.  $\text{CdI}_2$  to  $\text{ʒi}$ .

## UNGUENTUM CANTHARIDIS.

Olive oil is a good solvent for cantharidin, and a more uniform diffusion of the active matter of the insects is secured by the admixture of the oily extract with the melted wax, than by the direct incorporation of the powdered cantharides themselves. Used chiefly for maintaining the discharge from blistered surfaces, without causing undue irritation.

## UNGUENTUM CETACEI.

A mild dressing for blisters and sores. Apt to become rancid when long kept.

## UNGUENTUM CREASOTI.

Contains  $\text{ʒi}$ . of creasote to  $\text{ʒi}$ .

An ointment of carbolic acid of corresponding strength is now more generally used for external application in various skin diseases.

## UNGUENTUM ELEMI.

Mixed with an equal part of Ung. Resinæ, it forms an excellent "warm dressing" or gentle stimulant to indolent ulcers, bed-sores, anthrax, &c.

## UNGUENTUM GALLÆ.

Used chiefly in piles and prolapsus ani.

## UNGUENTUM GALLÆ CUM OPIO.

An anodyne astringent, sometimes preferable to the last in the treatment of irritable piles.

## UNGUENTUM HYDRARGYRI.

Contains half its weight of mercury, and from its colour is commonly called *blue ointment* or *blue butter*. The colour darkens somewhat by age, but even then nearly all the mercury exists in the free metallic state, and only a minute and variable amount of oxide is formed.

In the preparation of mercurial ointment, long and tedious trituration is required for the *extinction* of the mercury, i. e. until metallic globules cease to be visible, and various expedients have been recommended to facilitate this mechanical process. On the large scale the fatty matters are triturated with the metal by means of iron rollers which are driven rapidly round in a circular iron trough by steam power. A small quantity of suet is added to prevent the ointment being too soft.

*In Pharmacy.*—Three other mercurial preparations are formed with this as a basis. The Linim. Hydr. furnishes a more convenient form than either the simple or compound mercurial ointment.

*In Medicine.*—Locally, mercurial ointment is used as a vermin destroyer, and as a resolvent application to venereal buboes, chronic glandular swellings, certain cutaneous eruptions, and, when smeared over the face, it is said to prevent the pitting from small pox.

Constitutionally, inunction of this ointment is often resorted to, in order to obtain the general effects of mercury upon the



system, about ʒi. being well rubbed in night and morning into the inner surface of the legs or arms.

If too frequently rubbed upon the same part it is apt to produce a disagreeable eczematous eruption.

### UNGUENTUM HYDRARGYRI AMMONIATI.

Contains 62 grs. to ʒi.

White precipitate ointment is an efficacious means for destroying pediculi, and is one of the best applications for prurigo pedicularis, and porrigo (impetigo contagiosa) of the head. In many cases of chronic local eczema, its curative effects are very striking, and it is far less irritating to the skin than Ung. Hydr. Ox. Rubri (red precipitate ointment).

### UNGUENTUM HYDRARGYRI COMPOSITUM.

This is simply mercurial ointment diluted with wax and oil, with the addition of one ninth part of camphor.

### UNGUENTUM HYDRARGYRI IODIDI RUBRI.

The colour of this preparation is a bright scarlet. An irritating ointment, sometimes used in lupus, scrofulous and syphilitic sores, but it should be applied with caution on a tender skin. An excellent application in obstinate cases of goitre. It contains 16 grs. to ʒi.

### UNGUENTUM HYDRARGYRI NITRATIS.

This is the well known and popular *citrine* ointment, or as it is sometimes styled, *golden* ointment.

Nitrate of mercury is a colourless salt, and the yellow colour of the ointment appears to be due to the formation of a basic oxynitrate of mercury by the heated fatty matters. When the mixture is heated, nitrous fumes escape.

This ointment, when kept for some time, is liable to change

both in colour and consistence. It sometimes becomes of a dull greenish colour, and so hard and friable as to be unfit for use.

*In Medicine.*—Much employed as a stimulant to ulcers, and various forms of skin disease.

### UNGUENTUM HYDRARGYRI OXIDI RUBRI.

Red precipitate ointment is a useful stimulating preparation, but often requires to be diluted before use. The mercuric oxide must be very finely powdered before being mixed with the lard, so as to avoid gritty irritating particles. Contains 62 grs. to ʒi.

The ointment loses its fine salmon red colour when long kept, and when mixed with any resinous ointment, gradually passes through olive green to black.

For ophthalmic purposes, it is preferable to prepare the ointment with the freshly precipitated *yellow* mercuric oxide, which is in a much finer state of division (see Hydr. Oxid. Flavum).

### UNGUENTUM HYDRARGYRI SUBCHLORIDI.

Occasionally used in some skin affections. Contains 80 grs. to ʒi.

### UNGUENTUM IODI.

A dark orange brown ointment, which undergoes change when kept, and becomes pale upon the surface, owing to the union of some of the iodine with the fatty matter. Contains 16 grs. to ʒi.

When rubbed upon the skin it stains it orange, and if too long continued, sometimes produces a papular or pustular eruption.

This ointment is constantly employed as a local application in goitre, scrofulous glands, enlarged tonsils, and other forms of tumefaction.

## UNGUENTUM PICIS LIQUIDÆ.

Tar ointment is an active stimulant, and is used in cases of obstinate psoriasis, chronic scaly eczema, &c.

## UNGUENTUM PLUMBI ACETATIS.

A sedative and astringent ointment. Contains 12 grs. to ʒi.

## UNGUENTUM PLUMBI CARBONATIS.

Occasionally used to dress blistered or excoriated surfaces. Contains 62 grs. to ʒi.

## UNGUENTUM PLUMBI IODIDI.

A mildly stimulating ointment, useful in lupoid and other ulcerations. Contains 62 grs. to ʒi.

Its colour is a rich yellow, which fades a little on the surface after exposure to the air for some time.

## UNGUENTUM PLUMBI SUBACETATIS COMPOSITUM.

Commonly known as *Goulard's cerate*, after the Frenchman by whom it was originally employed and recommended. It is apt to become rancid and to assume a yellowish colour.

An excellent soothing and mild astringent ointment for burns, excoriations, chilblains, and irritable cases of eczema. A little extract of belladonna may sometimes be added to it with advantage.

## UNGUENTUM POTASSÆ SULPHURATÆ.

A stimulating ointment, used in some chronic skin diseases, e. g. ringworm. Contains 30 grs. to ʒi.

## UNGUENTUM POTASSII IODIDI.

The few grains of carbonate of potash are added with a view towards preservation from change caused by the fatty acids formed as the fat becomes rancid. Contains 64 grs. to ℥i.

It is apt to acquire a yellow tinge in time, in consequence of the liberation of a little iodine, and it is better to prepare it extemporaneously as required.

Applied to goitres and other indolent swellings.

## UNGUENTUM RESINÆ.

Commonly called *basilicon ointment*. An admirable gentle stimulant to indolent ulcers, or the raw surface following a blister or a burn. The addition of an equal weight of Ung. Elemi renders it of better consistence and more aromatic.

The composition of Holloway's ointment is stated to be—white wax  $12\frac{1}{2}$  parts, yellow wax and turpentine, of each, 6 parts, yellow resin 25, spermaceti 3, lard 50, olive oil  $62\frac{1}{2}$ . (Dorvault.)

## UNGUENTUM SABINÆ.

A green ointment; it should be kept in closely covered vessels.

Used chiefly for maintaining the discharge from a blistered surface (open blister), and it is sometimes smeared on seton threads to increase the discharge.

It is less acrid than cantharides ointment, and is not liable to cause strangury.

## UNGUENTUM SIMPLEX.

Frequently used as an unirritating dressing for wounds and raw surfaces. It forms the basis of eight other ointments.

### UNGUENTUM SULPHURIS.

Frequently employed in the treatment of scabies. But it is too irritant to apply to the severe or pustular forms of itch, and much harm is often done by rubbing it into eruptions of eczema or lichen which have been mistaken for scabies. Contains 1 part of sulphur in 5.

### UNGUENTUM SULPHURIS IODIDI.

A useful and energetic stimulant in some cases of psoriasis, chronic eczema, and ringworm. Contains 30 grs. to ʒi.

### UNGUENTUM TEREBINTHINÆ.

Sometimes used as a dressing for burns. It is not so strong as the Linimentum Terebinthinæ.

### UNGUENTUM VERATRIÆ.

Used chiefly in neuralgia, and in cases of gout and rheumatism. Contains 8 grs. to ʒi.

### UNGUENTUM ZINCI.

A very favourite mild astringent application in inflammation of the eyelids, and in many skin diseases in their early or acute stage. Contains 80 grs. of oxide of zinc to ʒi.

### UVÆ URSI\* FOLIA.

*Origin.*—The bearberry, *Arctostaphylos*† *Uva Ursi*, N.O. *Ericaceæ*, is a hardy evergreen shrub, bearing rose coloured flowers and scarlet berries. It grows on dry mountain stony

\* Because the fruit is sought after by wild animals (e. g. bears).

† "*ἄρκτος*, a bear; *σταφυλή*, a grape.

heaths in the W. and N. of Ireland, in Great Britain, and in the N. latitudes of Europe, Asia, and America.

*Characters.*—The leaves, which are the only part used in medicine, are distinctively known by their leathery, shining appearance, obovate form, and entire edges. They are deep green (brown when old) on the upper surface, paler and covered with a network of veins beneath. By these characters they are distinguished from the leaves of other plants of the same N.O., which are occasionally introduced as adulterants. Thus, the leaves of *Vaccinium Vitis-Idæa* (cowberry) are non-astringent, have revolute edges, sometimes slightly toothed, and are dotted on the under surface. Again, the leaves of the *Chimaphila umbellata* (pipsissewa) are known by their greater length, and their serrate edges. Box leaves (*Buxus sempervirens*) are oblong, and smooth on both surfaces. *Uva ursi* is inodorous when fresh, but acquires a feeble odour like old tea, when it is dried and powdered. It contains about 35% of tannic acid, and two crystallisable principles, arbutin,  $C_{12}H_{16}O_7$ , and urson,  $C_{20}H_{32}O_2$ .

*In Medicine.*—An astringent tonic, principally used in certain affections of the bladder and kidneys, e.g. gravel, vesical catarrh, &c. The infusion may be given freely in doses of from  $\bar{z}$ i. to  $\bar{z}$ ij. It darkens the colour of the urine.

## UVÆ.

*Origin.*—Different varieties of the vine, *Vitis\* vinifera*, N. O. Vitaceæ, furnish, according to the locality whence they come, different kinds of grapes, e.g. Malaga, Valencia, Smyrna, and Corinthian raisins; the latter constitute the small so called Zante currants. All the raisins of commerce come from the basin of the Mediterranean.

\* As if *Vitis*, from *vico*, to bind with twigs.



*Characters.*—The appearance of raisins is too well known to need description. They contain cane sugar and inverted sugar, the latter of which is gradually altered to a crystalline or granular mass of grape sugar (glucose), similar to what is seen on prunes and in candied honey.

*In Pharmacy.*—Used to flavour a few preparations.

*In Medicine.*—Taken freely they are gently laxative, but if the skins be eaten they are liable to cause flatulence and indigestion.

### VALERIANÆ RADIX.

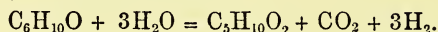
*Origin.*—The wild valerian, *Valeriana*\* *officinalis*, N. O. Valerianaceæ, is a large, herbaceous plant, from two to four feet high, bearing opposite pinnate leaves, and flesh coloured, odorous flowers in terminal cymes. The stamens are three in number, and the calyx of the ripe fruit is expanded into a feathery pappus.

It is common throughout Great Britain and Ireland, and frequents moist woods, ditches, sides of rivers, and damp, chalky places. When valerian grows in a low, damp soil, e. g. along the banks of a stream, it is much less active and less odorous than when found in an elevated habitat.

*Characters.*—The drug is known from most other roots by its occurrence as a brush-like bundle of fibrous roots, springing from a tuberculated stock or rhizome, and the strong, fetid odour of the dried root is very disagreeable to most people. Cats are said to be strongly attracted to it, and indeed the odour of the dried root bears no distant resemblance to the smell of cats' urine. Its most important constituent is a volatile oil, which exists in small quantity, and is a mixture of a hydrocarbon, *valerene*, ( $C_{10}H_{16}$ ), with *valerol* ( $C_6H_{10}O$ ).

\* Valerius, who first described it.

Valerol slowly oxidises into valerianic acid ( $C_5H_{10}O_2$ ), known by its sour, nauseous smell. Valerianic acid was formerly obtained by distillation from the root —



It is now procured artificially from fousel oil (see Sodæ Valerianas).

*In Medicine.*—A nervous stimulant and antispasmodic, used chiefly in hysterical and hypochondriacal affections. Trousseau recommended it especially in diabetes insipidus.

The Infusion and Tincture may be given in doses of  $\text{ʒi.}$  or  $\text{ʒij.}$ , and  $\text{ʒi.}$  or  $\text{ʒij.}$ , respectively.

### VAPORES.

Inhalations consist of the vapour of water, medicated with various substances, and taken into the lungs by the aid of suitable apparatus. This class of remedies is chiefly employed in laryngeal and pulmonary affections, and is susceptible of many useful applications.

By the term “pulverised” or “atomised” fluid is meant the reduction of a liquid by an appropriate instrument into such fine spray that it can be inhaled without inconvenience.

### VAPOR ACIDI HYDROCYANICI.

Prussic acid is so volatile that it is not necessary to put hot water into the inhaler. 15m. of the diluted acid would contain a little more than  $\frac{1}{4}$  gr. (0.27) of absolute HCy. Useful for allaying pain, spasm, and irritability of the air passages.

### VAPOR CHLORI.

Since chlorinated lime gives off chlorine gas when simply exposed to the air, it is sufficient to damp the bleaching powder with water and to inhale the vapour thence arising.

A deodoriser and antiseptic, useful in bronchitis with copious fetid secretion, and in gangrene of the lung.

### VAPOR CONIÆ.

In this case some of the volatile alkaloid conia itself is inhaled, being liberated from the extract of hemlock by the fixed base potash. But the proportion of conia in the quantity of the mixture to be inhaled must be almost infinitesimal. A much more reliable inhalation is obtained by adding a few drops of Liq. Potassæ to ʒi. of Succus Conii.

A sedative and anodyne inhalation.

### VAPOR CREASOTI.

A stimulant and deodorising inhalation suitable for bronchorrhœa.

### VAPOR IODI.

Inhalation of the vapour from ʒi. of Tr. Iodi, sometimes affords relief in phthisical laryngitis, &c.

### VERATRI VIRIDIS RADIX.

The American hellebore, *Veratrum viride*, N. O. Melanthaceæ, is indigenous throughout a great part of N. America, and inhabits swamps, wet meadows, and the banks of streams.

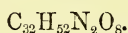
*Characters.*—The drug, as found in commerce, is usually in small pieces, and consists of a rhizome or rootstock about one inch by half an inch, to which are frequently attached numerous long yellowish roots, marked by close set indentations which are characteristic.

The root has a bitter acrid taste. Its most important constituent is an alkaloid, termed veratria, which exists in combina-

tion with gallic acid. According to the recent observations of Dragendorff, the active principle of hellebore is not identical with the veratria of sabadilla.

*In Medicine.*—See Veratria.

## VERATRIA.



*Origin.*—An alkaloid obtained from the seeds of Cevadilla (see p. 594), in which it is associated with a second alkaloid, sabadillin,  $\text{C}_{20}\text{H}_{26}\text{N}_2\text{O}_5$ , and another resinoid base.

*Preparation.*—The principal steps of the process are these:—

1. Exhaust with rectified spirit the bruised seeds of sabadilla, separated from the fruit.
2. Concentrate the tincture thus obtained by distillation, and pour the residue into a large bulk of cold water. This precipitates much resin and some oily and colouring matters.
3. Filter, and precipitate the veratria from the aqueous solution by ammonia.

The impure veratria is purified by washing it with water, dissolving it in HCl, and re-precipitation by ammonia. About 0.3 or 0.4% of veratria is procurable from the seeds.

*Characters and Tests*—Commercial veratria is a white or greyish white powder appearing crystalline under the microscope, and large crystals can be obtained from its spirituous solution. The German veratria is purer and much more active than Magendie's veratria, and the so called American veratria, a snuff-coloured powder, is an impure resinoid mixture.

According to the recent inquiries of Bullock and H. C. Wood, in America, the so called veratria is a complex body, and contains two alkaloids, *viridia* and *veratroidia*, associated with resin. The former of these bases is soluble in ether, the latter insoluble. The resin is inert therapeutically.

The local action of veratria, e. g. by inunction, exhibits itself by causing a sensation of warmth and prickling, passing into a feeling of coldness and numbness. Occasionally a purplish itchy eruption is produced.

The remote or systemic action of (German) veratria appears to be much the same upon all classes of animals, but there is no fatal case of poisoning in man by veratria on record. The symptoms which usually follow a dose of  $\frac{1}{12}$  or  $\frac{1}{6}$  gr. in man are, nausea, vomiting, tingling in the throat and stomach, diarrhœa, abdominal pains, depression, weak and irregular pulse, with marked reduction of its rate. The sensorium is generally unaffected.

Its action is exerted chiefly upon the muscular, respiratory, and nervous systems, and it destroys the excitability of striped muscular fibre, and paralyses the heart.

Viridia is not an emetic or cathartic ; veratroidia is an irritant emetic, and sometimes a cathartic. By means of viridia, according to these authors, all the peculiar sedative influence of green hellebore can be obtained without the risk of inducing the nausea and vomiting which occasion so much discomfort and even danger.

The most remarkable character of veratria is its violent irritant effect on the Schneiderian membrane. Although inodorous, an almost invisible quantity, if snuffed into the nostrils, excites troublesome sneezing, irritation, and a copious flux from the nose and eyes.

Fuming sulphuric acid colours veratria yellow, red, and violet, in succession; this is a delicate test. When dissolved in 1000 parts of boiling water, the solution is sensibly acrid.

It is sometimes adulterated with lime or magnesia, which are left behind on incineration.

*In Medicine.*—Veratria has been recommended internally in a number of affections, but the tincture of veratrum viride is to be preferred as being less irritant than solutions of the alkaloid

itself. Internally, veratria is chiefly recommended as a depressor of the pulse and temperature in acute inflammatory affections, such as articular rheumatism, and pneumonia. It has been proposed to substitute it for colchicum in the treatment of gout. It is more often employed externally, chiefly in neuralgia, and has been praised as a local application in gouty and rheumatic swellings.

Of the ointment, a piece about the size of a small nut may be rubbed upon the skin, care being taken that the skin be not broken. It may with advantage be combined with an equal quantity of aconitia ointment. The dose of (German) veratria internally, in pill, is about  $\frac{1}{30}$  gr. to begin with, cautiously increased.

### VINA.

Wines, in pharmacy, are simply alcoholic tinctures prepared with sherry or orange wine instead of other forms of alcohol. Medicated wines are more liable to alter than tinctures, and as a general rule, there seems to be little advantage gained in retaining this class of preparations.

All the Vina are vegetable tinctures except the antimonial and chalybeate wines.

### VINUM ALOES.

A warm stomachic purgative. Dose, the same as that of Tinctura Aloes.

### VINUM ANTIMONIALE.

The advantages of this preparation are, that it offers a convenient means of administering tartar emetic in solution, and it keeps better than an aqueous solution of that salt, which is prone to spontaneous decomposition. It contains 2 grs. of tartar emetic in  $\mathfrak{z}\text{i}$ .



Unless pure tartar emetic and sound sherry be employed in its preparation the solution will not be clear, and more or less of the antimonial salt may be precipitated by impurities in the wine.

### VINUM AURANTII.

An aromatic wine, about two-thirds the strength of sherry.

*In Pharmacy.*—Used for preparing the Vinum Ferri Citratis, and Vinum Quiniæ.

### VINUM COLCHICI.

A favourite form for prescribing colchicum in gout.

### VINUM FERRI.

When iron wire is *partially* immersed in sherry for a month, the metal slowly oxidises, and is converted by the vegetable acids of the sherry into various saline combinations, principally potassio-tartrate of iron, and probably some citrate, malate, and acetate of iron are also formed.

A mild chalybeate; it may be prescribed in combination with Liq. Arsenicalis without precipitation being caused.

### VINUM FERRI CITRATIS.

Contains 8 grs. of ammonio-citrate of iron in  $\bar{3}$ i. of orange wine.

### VINUM IPECACUANHÆ.

Much used as an expectorant and diaphoretic, and if combined with laudanum, a fluid preparation analogous to Dover's powder is obtained. In full doses,  $\bar{3}$ ss., it operates as an emetic.

According to Dr. Dyce Duckworth, an acetous solution of ipecacuanha is more active than a spirituous solution.

## VINUM OPII.

Sometimes termed Sydenham's laudanum, which however contained saffron in addition. It deposits a good deal on keeping. An aromatic opiate, occasionally applied locally to the conjunctiva, but for this purpose the formula of the British Pharmacopœia, 1864, was preferable, on account of the absence of the aromatics.

## VINUM QUININÆ.

An agreeable form of taking quinine.

It contains 1 gr. to  $\bar{3}$ i., and is one-eighth the strength of Tinctura Quiniæ.

## VINUM RHEI.

A warm cordial laxative, aromatised with Canella bark.

## VINUM XERICUM.

Wine is the fermented juice of the grape or other fruit which has not been subjected to distillation.

All wines contain aldehyd, colouring matter, various acids, compound ethers, &c., and the amount of alcohol varies from 8 to 25%.

The different kinds of wine derive their special qualities from several circumstances, such as the mode of preparation, the nature of the grape, and the climate under which it was grown.

*Red Wines* (e. g. port) are produced from the juice of dark grapes, fermented along with their skins; *white wines* (e. g.

sherry), from white grapes, or from the juice of dark grapes, fermented apart from their husks.

The "Sack" (*sec*, dry) of Shakspeare was probably a sherry.

*In Pharmacy.*—Sherry is employed as a menstruum in the case of seven medicated wines.

*In Medicine.*—The physiological action and therapeutic uses of alcohol have already been referred to at p. 654, and it will suffice to say here that the medicinal effects of the alcohol in wine are considerably modified by its association with those other volatile and ethereal ingredients which always accompany it.

## ZINCUM.

Zn = 65.

*Origin.*—The principal ores of zinc are *blende* (ZnS) and *calamine* (ZnCO<sub>3</sub>). From these the metal is liberated by roasting, and then calcining with charcoal, when the metal rises in vapour and readily condenses.

In the vegetable kingdom zinc has been found in a species of violet which grows on the calamine hills of Rhenish Prussia.

Zinc is a brittle, blueish white metal, and the ordinary impure zinc of commerce requires to be heated to nearly 300° F. before it is sufficiently malleable to be rolled into sheets.

The sp. gr. of zinc is about 7, it melts at 773°, and at a full red heat burns with a brilliant flame, and emits white fumes of oxide of zinc.

*Chemical Relations.*—Zinc is a dyad in all its combinations, but it sometimes gives rise to basic salts, e. g. Zinci Carbonas. Ordinary zinc dissolves easily in most acids, displacing their hydrogen, and this gas is also liberated when zinc is heated with the caustic alkalies:— $\text{Zn} + 2\text{KHO} = \text{ZnK}_2\text{O}_2 + \text{H}_2$ . The pure

metal does not readily dissolve in dilute acids, except under the influence of a voltaic combination with some other metal (e. g. platinum), or with charcoal. Commercial zinc is apt to contain arsenic, iron, and copper.\* Arsenic can be detected by sulphuretted hydrogen giving a yellow precipitate of  $\text{As}_2\text{S}_3$  (orpiment) in the *acidulated* solution. Iron, by a purple colour with tincture of galls, or by a blue precipitate with the prussiates of potash, or by ammonia producing a reddish brown precipitate, insoluble in excess of the alkali. Copper, by the blue solution produced when ammonia is added in excess. The *tests* for a pure zinc salt are: 1. Production of a *white* precipitate of  $\text{ZnS}$  with sulphide of ammonium (or with  $\text{H}_2\text{S}$  in *acetic* solution). Zinc is the only metal which yields a white sulphide. Fixed and volatile alkalies give with zinc white precipitates, which are entirely soluble without colour in an excess of the reagent.

*In Pharmacy.*—The chloride and sulphate are obtained by direct solution of metallic zinc in their respective acids.

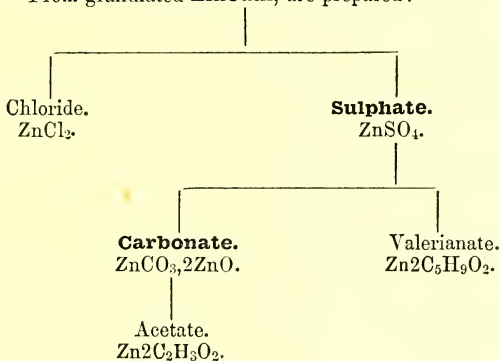
In the arts, zinc has numerous applications, e. g. alloyed with copper it forms *brass*; with nickel, *German silver*; and, as a coating on iron (*galvanised iron*), it protects the latter from oxidation.

Zinc is extensively used in galvanic combinations, and forms the positive plate of all the ordinary forms of voltaic battery.

\* To save repetition, the tests for zinc and its impurities are given here once for all.

## GENEALOGICAL TABLE OF THE ZINC COMPOUNDS.

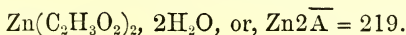
From granulated **Zincum**, are prepared :—



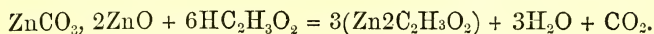
*In Medicine.*—The leading effects of the compounds of zinc are those of (1) an astringent, e.g. Zinci Acetas, Zinci Sulphas; (2) emetic, e. g. Zinci Sulphas, in full doses; (3) tonic and nerve alterative, e. g. Oxide and Valerianate; (4) caustic, e. g. Chloride.

By long continued use the preparations of zinc act as slow poisons, and produce emaciation, constipation, and serious depression.

### ZINCI ACETAS.



*Preparation.*—Dissolve carbonate of zinc in acetic acid—



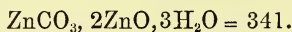
Filter, and crystallise out the acetate from the solution.

Oxide of zinc or metallic zinc may be substituted for the carbonate.

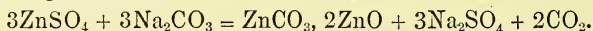
*Characters and Tests.*—Characterised by its thin, lustrous, micaceous crystals, with a sharp, astringent taste. Known to be an acetate by evolving acetous vapours on the addition of sulphuric acid; and freedom from hydrochloric or sulphuric acid (possibly present in the acetic acid used in its preparation) is shown by its solution yielding no precipitate with nitrate of silver or chloride of barium respectively.

*In Medicine.*—Chiefly used as a local astringent in cases of ophthalmia, and as an injection in gonorrhœa, 1 or 2 grs. in  $\bar{3}$ i. of water. Large doses are emetic in action.

### ZINCI CARBONAS.



*Preparation.*—Add carbonate of sodium to sulphate of zinc, in boiling solution—



Wash and dry the precipitate. If cold solutions be used, a gelatinous precipitate is formed, which is washed with difficulty. If the neutral carbonate of zinc were produced, no effervescence would occur.

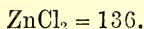
*Characters and Tests.*—A very soft, loose, white powder, resembling magnesia. The native impure carbonate (*lapis calaminaris*) was formerly officinal, but the pink powder, sold as *prepared calamine*, was almost universally a spurious article, and consisted mainly of sulphate of barium coloured with ferric oxide.

*In Pharmacy.*—Used for preparing the acetate and oxide of zinc.

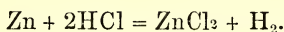
*In Medicine.*—This preparation is mildly astringent, and is sometimes used in the form of ointment to excoriations, burns, &c. *Turner's cerate* was an ointment of calamine.



## ZINCI CHLORIDUM.

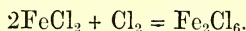


*Preparation.*—Dissolve zinc in hydrochloric acid, and evaporate the solution—

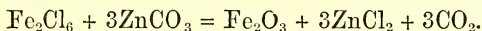


Zinc sometimes contains a little iron, and the steps directed to be taken for its removal are these:—

1. Add chlorine solution to the above liquid, containing  $\text{FeCl}_2$  and  $\text{ZnCl}_2$ ; the ferrous is converted into ferric chloride—



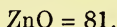
2. Then add carbonate of zinc, and shake. Ferric oxide is precipitated, and chloride of zinc is formed—



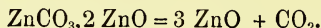
*Characters and Tests.*—A soft, white, waxy substance, remarkable for its rapid deliquescence. It occurs either in opaque white tablets, or cast into rods like nitrate of silver. The white flocculent precipitate, generally left when the chloride is dissolved in water, is oxychloride of zinc. Squire mentions the fact that a mixture of equal weights of oxide and chloride of zinc (i.e. an oxychloride) will keep dry in a bottle for a long time.

*In Medicine.*—Chiefly used externally as an escharotic and stimulant, and, in weak solution, gr. i. to ʒi., as an injection in gonorrhœa. It has been much employed as an application to cancerous and intractable sores, lupus, &c., and various forms have been devised for its use, e. g. Canquoin's paste, Landolfi's caustic, Fell's caustic. The Liq. Zinci Chlor. is a very concentrated solution, containing 35·7 grs. to ʒi. Sir W. Burnett's disinfecting fluid is a solution of  $\text{ZnCl}_2$ , and contains 200 grs. in ʒi. While it destroys putrid exhalations, the solution is odourless itself, and is sometimes used to preserve anatomical subjects.

## ZINCI OXIDUM.



*Preparation.*—Prepared in a similar manner to lime and magnesia, viz., by ignition of the carbonate until all the carbonic acid gas is driven off—

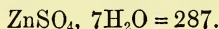


*Characters and Tests.*—Oxide of zinc is never perfectly white, unless obtained by combustion of the metal in air (Hubbuck's oxide of zinc), but it is then liable to contain particles of metal. It is remarkable that heat renders it yellow; but at an intense heat it fuses and sublimes. Commercial specimens are often impure from faulty preparation, and contain undecomposed carbonate and other basic salts of zinc.

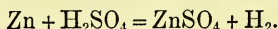
*In Medicine.*—Extensively employed as a local application in the form of ointment to excoriated surfaces, eczema, and all irritable conditions of the skin.

Internally, it is used principally in nervous disorders, e. g. chorea and epilepsy, in doses of two or three grains, in pill.

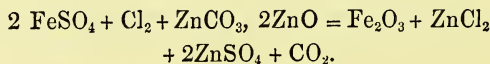
## ZINCI SULPHAS.



*Preparation.*—Dissolve zinc in diluted sulphuric acid—



To purify the sulphate of zinc from any sulphate of iron, proceed as in the purification of chloride of zinc, by adding chlorine and carbonate of zinc, the only difference being in the action of chlorine on the ferrous sulphate which is present in the zinc solution—



Although a little chloride of zinc is thus necessarily formed

along with the sulphate, yet on evaporating and crystallising the solution, the more soluble zincic chloride will be retained in the mother liquor.

*Characters and Tests.*—Commonly called *white vitriol*. Its small prismatic crystals bear considerable resemblance to those of sulphate of magnesium, from which they are readily distinguished by their disagreeable styptic taste. It reddens vegetable blues, and effloresces slightly in dry air.

Like the sulphates of iron, magnesium, and quinia, this salt contains seven molecules of water of crystallisation.

When heated, it dissolves in its liberated water of crystallisation (aqueous fusion),  $\frac{6}{7}$  of which are expelled at  $212^{\circ}$  F., and the remainder at a higher heat.

*In Pharmacy.*—Used for preparing two insoluble salts of zinc, viz., carbonate and valerianate.

The reaction for the preparation of sulphate of zinc is the common method for obtaining hydrogen gas, which is itself employed as a reducing agent, e. g. in the preparation of Ferrum Redactum.

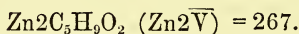
*In Medicine.*—The chief effects of sulphate of zinc are, in small doses, tonic and astringent, and, in large doses, emetic.

As a tonic it is principally employed in spasmodic and nervous diseases, e. g. epilepsy, chorea, and whooping cough; and, in solution, from 1 to 3 grs. in  $\mathfrak{z}\text{i}$ ., it is frequently used as an injection in leucorrhœa, gonorrhœa, and some kinds of ophthalmia. Dried sulphate of zinc in the form of powder, rods, paste, or ointment, was particularly recommended by Sir J. Simpson as a caustic in ulcers of the uterus, lupus, urethral vascular tumours, condylomata, &c. The advantages attributed to it are its being powerful, rapid, manageable, safe, and non-deliquescent.

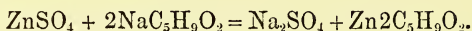
Its emetic action is prompt and without danger, not followed by distressing nausea, and for ordinary cases, there is no better combination than sulphate of zinc, gr. 15-20, with Vinum Ipecacuanhæ,  $\mathfrak{z}\text{i}$ — $\mathfrak{z}\text{ij}$ ., in  $\mathfrak{z}\text{ij}$ . of Aqua Cinnamomi.

In over doses sulphate of zinc acts as an irritant poison, but seldom proves fatal, as it is generally quickly rejected by vomiting. Bland drinks with opiates should be given.

### ZINCI VALERIANAS.



*Preparation.*—Mix strong solutions of sulphate of zinc and valerianate of sodium—



Boil, cool, skim off the crystals of valerianate of zinc which separate, and concentrate by a gentle heat, so as to obtain an additional product.

*Characters and Tests.*—Distinguished at once by its brilliant, scaly crystals, which possess a fetid odour of valerianic acid. It requires 160 parts of cold water for solution, and the liquid becomes turbid when heated, but clears again on cooling. When heated to redness it leaves a residue of oxide of zinc. Commercial valerianate of zinc always retains a little sulphate of zinc, which is very difficult to remove by washing.

It is stated that acetate of zinc impregnated with oil of valerian is sometimes substituted for this salt, and butyrate of zinc has been sold for the valerianate, which it closely resembles.

In any case, the valerianate is apt to be contaminated with butyrate of zinc, as has been explained under Sodæ Valerianas, and the following officinal test for detecting butyric acid depends upon the greater insolubility of butyrate of copper. Heat the suspected salt with dilute  $\text{H}_2\text{SO}_4$  (to liberate the fatty acids), and to the distillate add acetate of copper. If butyric acid be present, an immediate pale blue precipitate of cupric butyrate will form, whereas cupric valerianate will not form for a little time; and being far more soluble than the butyrate, it will only slowly collect in the form of greenish oily

drops, which gradually pass into a light blue crystalline deposit (Larocque and Huraut).

*In Medicine.*—Used as a nervine tonic and antispasmodic in hysteria, epilepsy, and some cases of neuralgia.

The average dose is 2 grs. in pill.

## ZINCUM.

### ZINCUM GRANULATUM.

See p. 721.

## ZINGIBER.

*Origin.*—The ginger plant, *Zingiber officinale*, N. O. Zingiberaceæ, is of low size, bears dingy yellow, aromatic flowers, and produces a creeping, irregularly branched rhizome or rootstock. Although the stems, when bruised, are slightly fragrant, yet the virtues of the plant chiefly reside in the rhizome, which is prepared for commerce by being deprived of its epidermis, and then dried carefully in the sun. Common or black ginger owes its colour to being over heated.

*Characters.*—The appearance and aromatic qualities of ginger are universally familiar, and the best specimens are firm and not too white. Ginger is sometimes artificially bleached, or is washed over with whiting and water. Inferior ginger is fibrous, light, and is often worm eaten. ♦

The main constituents of ginger are starch, resin, and a volatile oil which corresponds in composition to oil of turpentine.

*In Medicine.*—Ginger is extensively used as a cordial addition to many forms of medicine, e. g. purgatives, opiates, bitters, &c. When chewed, it produces a copious flow of saliva, and when snuffed up the nostrils, it excites violent sneezing.





## APPENDIX.



## APPENDIX.

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THE Appendices of the Pharmacopœia contain a number of articles intended for the purposes of analysis, i. e., of inquiring into the nature and composition of substances, or of ascertaining the presence of adulterations in the officinal drugs. Appendices I. and II. are concerned with qualitative analysis, which seeks to determine the presence and *nature* of certain chemical bodies, irrespective of their actual quantity; while Appendix III. has reference to quantitative analysis, which aims at estimating the precise *amount* of the component parts of any compound, and by which the strength of many chemical compounds may be accurately determined.

### APPENDIX I.

ALCOHOL,  $C_2H_5$ , HO.—For an account of its preparation and characters, see p. 649. Test for Oleum Ricini, and for Aconitia, Atropia, Acidum Carbolicum, and Zinci Valerianas.

BENZOL (or benzine).  $C_6H_6$ .—Not to be confounded with benzoyl ( $C_7H_5O$ ), the radical of essential oil of almonds, mentioned under Styrax Præparatus. Test for Gurjun balsam as an adulterant of Copaiba.

BORACIC ACID.  $H_3BO_3$ .—To prepare solution of boracic acid, App. II. (see p. 162).

CHLORIDE OF BARIUM.  $BaCl_2, 2H_2O$ .—To prepare solution of chloride of barium, App. II.

COPPER FOIL. Cu.—Test for Acidum Nitricum; and for arsenic in Acidum Hydrochloricum, and Ferri Phosphas.

GOLD, FINE. Au.—To prepare solution of chloride of gold, App. II.

HYPOSULPHITE OF SODA.  $Na_2S_2H_2O_4, 4H_2O$ .—To prepare the volumetric solution of hyposulphite of soda, App. III.

INDIGO.  $C_8H_5NO$ .—The blue colouring matter (indigotin) is not soluble in

water or alkaline solutions, but forms several compounds with sulphuric acid. To prepare solution of sulphate of indigo, App. II.

ISINGLASS.—A pure form of gelatin obtained from the inner membrane of the swimming bladder of sturgeons (*Acipenser*), and other fishes. To prepare solution of gelatin, App. II.

LITMUS.—Obtained principally from *Roccella tinctoria*, N. O. Lichenes, and made up with chalk or plaster of Paris into small cakes for the market. To prepare litmus tincture, App. I.

LITMUS PAPER, BLUE.—Test for acids.

LITMUS PAPER, RED.—Test for bases.

NOTE.—The action of acids and bases on litmus is thus explained: ordinary litmus contains a *blue* salt, viz., lithmate of calcium. But since free lithmic acid is *red*, and possesses very feeble affinities, when any other acid, even the weakest, is added to litmus, lithmic acid is displaced, and so the red colour is produced. Again, all metallic lithmates are blue, therefore when any base is added to reddened litmus (i. e., neutralising the free lithmic acid) the blue colour is restored.

LITMUS TINCTURE.—Test for Carbo Animalis Purificatus.

OXALIC ACID OF COMMERCE.—To prepare oxalic acid, purified, App. I.

OXALIC ACID, PURIFIED.— $\text{H}_2\text{C}_2\text{O}_4$ ,  $2\text{H}_2\text{O}$ .—To prepare oxalate of ammonia App. I.; and the volumetric solution of oxalic acid, App. III.

OXALATE OF AMMONIA.  $(\text{NH}_4)_2\text{C}_2\text{O}_4$ ,  $\text{H}_2\text{O}$ .—To prepare solution of oxalate of ammonia, App. II.

PLASTER OF PARIS.  $\text{CaSO}_4$ .—To prepare solution of sulphate of lime, App. II.

PLATINUM BLACK. Pt.—Test for Alcohol Amylicum.

PLATINUM FOIL. Pt.—To prepare solution of perchloride of platinum, App. II.

RED PRUSSIATE OF POTASH (Ferridcyanide of Potassium).  $\text{K}_6\text{Fe}_2\text{Cy}_{12}$ .—To prepare solution of red prussiate of potash, App. II.

SUBACETATE OF COPPER OF COMMERCE (Verdigris).  $\text{Cu}_2\text{C}_2\text{H}_3\text{O}_2$ ,  $\text{CuO}$ ,  $6\text{H}_2\text{O}$ .—To prepare solution of acetate of copper, App. II.

SULPHATE OF COPPER, ANHYDROUS.  $\text{CuSO}_4$ .—Test for water in alcohol, App. I. (See p. 651.)

SULPHIDE OF IRON.  $\text{FeS}$ .—To prepare sulphuretted hydrogen, App. I.— $\text{FeS} + \text{H}_2\text{SO}_4 = \text{FeSO}_4 + \text{H}_2\text{S}$ .

SULPHURETTED HYDROGEN.  $\text{H}_2\text{S}$ .—To prepare solution of sulphide of ammonium, App. II. Test for many metals.

NOTE.—Sulphuretted hydrogen is an invaluable agent in chemical analysis.

for the detection of metals, and for effecting their separation into distinct groups. All metallic sulphides are insoluble in water, except the sulphides of the alkalis (K, Na,  $\text{NH}_4$ , L) and alkaline earths (Ba, Ca, Mg, Sr); therefore all other metals are precipitable as sulphides either by sulphuretted hydrogen or by sulphide of ammonium. But the conditions under which the various sulphides are thrown down differ materially, and hence, by modifying these conditions, the whole family of the precipitable metals can be divided into different sections.

I. Some sulphides are insoluble in either dilute acids or alkalis, and accordingly it is immaterial in which condition the solution is; i. e. either sulphuretted hydrogen or sulphide of ammonium may be used as the precipitating agent; e. g. Hg, Ag, Pb, Bi, Cu, Cd (see *Cadmii Iodidum*).

II. Some sulphides are soluble in alkalis, and therefore the solution must be acidified previous to precipitation, i. e. sulphide of ammonium must *not* be used as it would redissolve the metallic sulphide: e. g. Sn, Sb, As (see *Liquor Arsenicalis*, and the preparations of Antimony *passim*).

III. On the other hand, some sulphides are soluble in dilute mineral acids, and accordingly the solution must be rendered alkaline previous to precipitation, or, what amounts to the same thing, sulphide of ammonium may be used as the precipitant. Sulphuretted hydrogen will not directly precipitate them (see *Ferri Sulphas*); e. g. Ni, Co, Fe, Mn, and Zn (see the salts of Zinc *passim*). Of this group of sulphides, sulphide of zinc alone is insoluble in *acetic acid*.

As to colour, most of the sulphides are *black*, e. g. Hg, Ag, Pb, Bi, Cu, Ni, Co, Fe, &c.; one only is *white*, viz., sulphide of zinc,  $\text{ZnS}$ ; three are *yellow*, viz., the sulphides of arsenic,  $\text{As}_2\text{S}_3$ , cadmium,  $\text{CdS}$ , and tin,  $\text{SnS}_2$ ; and one is *orange*, viz. sulphide of antimony,  $\text{Sb}_2\text{S}_3$ .

TIN, GRANULATED. Sn.—To prepare solution of chloride of tin, App. II.

TURMERIC.—Its colouring matter (curcumin) is nearly insoluble in water, but is freely taken up by alcohol and ether. Alkalis change the yellow colour of turmeric to brown, but most acids, with the exception of boracic acid, produce no change of tint. To prepare tincture of turmeric, App. I.

TURMERIC PAPER.—Test for alkalis.

TURMERIC TINCTURE.—To prepare turmeric paper, App. I.

## APPENDIX II.

SOLUTION OF ACETATE OF COPPER.  $\text{Cu}_2\text{C}_2\text{H}_3\text{O}_2$ ,  $\text{H}_2\text{O}$ .—Test for butyric acid in *Zinci Valerianas*: butyric acid precipitates the acetate of copper immediately.

SOLUTION OF ACETATE OF POTASH.  $\text{KC}_2\text{H}_3\text{O}_2$ .—Test for Acidum Tartaricum; distinguishes it from Acidum Citricum.

SOLUTION OF ACETATE OF SODA.  $\text{NaC}_2\text{H}_3\text{O}_2, 3\text{H}_2\text{O}$ .—Testing Calcis Phosph. Præcip. for iron, to neutralise the excess of the nitric acid employed.

SOLUTION OF ALBUMEN.—Test for metaphosphoric acid ( $\text{HPO}_3$ ) in Acidum Phosph. Dil.; test for Acidum Carbolicum and for Creasotum.

SOLUTION OF AMMONIO-NITRATE OF SILVER.  $\text{AgNO}_3, 2\text{NH}_3$ .—Test for Acidum Arseniosum, and Acidum Phosphoricum; yellow precipitate with each.

SOLUTION OF AMMONIO-SULPHATE OF COPPER.  $\text{CuSO}_4, 4\text{NH}_3$ .—Test for sulphide of ammonium in Liq. Ammoniae Fortior; gives a black precipitate,  $\text{CuS}$ .

SOLUTION OF AMMONIO-SULPHATE OF MAGNESIA.—Test for phosphoric acid in Ammoniae Phosphas and Ferri Phosphas; gives a white precipitate of triple phosphate,  $\text{MgNH}_4\text{PO}_4$ .

SOLUTION OF BORACIC ACID.—To detect the adulteration of rhubarb with turmeric. Alkalies could not be used for this purpose, as they act on rhubarb similarly to turmeric.

SOLUTION OF BROMINE.  $\text{Br}$ .—Test for iodine in bromides of ammonium and potassium.

SOLUTION OF CARBONATE OF AMMONIA.  $\text{N}_4\text{H}_{16}\text{C}_3\text{O}_8$ .—Test for Bismuthum Purificatum; Zinci Carb., and Zinci Oxidum.

SOLUTION OF CHLORIDE OF AMMONIUM.  $\text{NH}_4\text{Cl}$ .—In testing for magnesian salts, to prevent the premature precipitation of magnesia by ammonia. Triple phosphate is insoluble in chloride of ammonium.

SOLUTION OF CHLORIDE OF BARIUM.—Test for sulphuric acid or a soluble sulphate.

SOLUTION OF CHLORIDE OF CALCIUM.  $\text{CaCl}_2$ .—Test for citric acid in Potassæ Citras; for arsenic acid in Sodæ Arsenias.

SOLUTION (SATURATED) OF CHLORIDE OF CALCIUM.—Test for percentage of nitrous ether in Spiritus Ætheris Nitrosi.

SOLUTION OF CHLORIDE OF GOLD.  $\text{AuCl}_3$ .—Test for Atropia.

SOLUTION OF CHLORIDE OF TIN.  $\text{SnCl}_2$ .—Test for Hydrargyrum Ammoniatum.

NOTE.—Stannic chloride,  $\text{SnCl}_4$ , could not be formed in the presence of nascent hydrogen.  $\text{Sn} + 2\text{HCl} = \text{SnCl}_2 + \text{H}_2$ .

SOLUTION OF GELATIN.—Test for Acidum Tannicum; and Ulmi Cortex.

NOTE.—Should be termed solution of isinglass, which is introduced into App. I. for this purpose.

SOLUTION OF IODATE OF POTASH.  $\text{KIO}_3$ .—Should be omitted from the



Appendix, as it is no longer recognised as a test. In the first edition of the Pharmacopœia it was used as a test for sulphurous acid in Acidum Aceticum.

**SOLUTION OF IODIDE OF POTASSIUM.**  $KI$ .—Test for lead (see Lead salts *passim*).

**SOLUTION OF OXALATE OF AMMONIA.**  $(NH_4)_2C_2O_4$ .—Test for lime (see Calcium salts *passim*).

**SOLUTION OF PERCHLORIDE OF PLATINUM.**  $PtCl_4$ .—Test for potash (see Potassium salts *passim*); for nicotia in Tabaci Folia.

**SOLUTION OF PHOSPHATE OF SODA.**  $Na_2HPO_4$ .—Test for magnesia (see Magnesium salts *passim*).

**SOLUTION OF RED PRUSSATE OF POTASH.**  $K_6Fe_2Cy_{12}$ .—Test for *ferrous* salts (see salts of Iron *passim*).

**SOLUTION OF SULPHATE OF INDIGO (Sulphindigotic Acid).**  $HC_8H_4NSO_4$ .—Test for Liq. Chlori; and for nitric acid in Bismuthi Carbonas.

**SOLUTION OF SULPHATE OF IRON.**  $FeSO_4$ .—Test for Acidum Hydrocyanicum; and for nitric acid in Acidum Phosphoricum, Liq. Ferri Pernitratis; and for nitrous acid in Spiritus Ætheris Nitrosi.

**SOLUTION OF SULPHATE OF LIME.**  $CaSO_4$ .—Test for oxalic acid in Acidum Tartaricum.

**SOLUTION OF SULPHIDE OF AMMONIUM.**  $(NH_4)_2S$ .—For its preparation see p. 105. Test for copper or lead in Liq. Ammon. Fort., and Pot. Acet.; test for zinc (see Zinc salts *passim*); and for cadmium (see Cadmii Iodidum).

**NOTE.**—Sulphydrate of ammonium,  $NH_4HS$ , is also frequently used in the laboratory.

**SOLUTION OF TARTARIC ACID.**  $H_2C_4H_4O_6$ .—Test for potassium (see Pot. Acet.), and, generally, to distinguish potassium from sodium salts: to prevent precipitation of oxide of iron in testing Ferri Phosph. for phosphoric acid.

**SOLUTION OF YELLOW PRUSSATE OF POTASH.**  $K_4FeCy_6$ .—Test for *ferrie* salts (see salts of Iron *passim*); and for copper salts (see Cupri Sulphas).

### APPENDIX III.

This Appendix, as has already been remarked, refers to quantitative analysis, which is effected upon one or other of two principles.

1. Analysis by weight—gravimetric, i. e. the precipitation of a body in the free state, or in some definite combination, which is then weighed, and so the quantity of the body ascertained by a simple calculation. The requisite operations for this mode of procedure are troublesome, and involve much expenditure of time, and it is unnecessary in this place to allude to them further. But many chemical assays are now more simply effected by—

2. Analysis by measure, i. e. volumetric—with which this Appendix deals. Briefly, this method consists in noting the volume or bulk of a test liquid of known strength required to be added to a substance before a given chemical effect is produced upon a known quantity of the substance under examination. Or, as it may otherwise be expressed, the quantity of a body is estimated by converting it from a certain definite state to another equally definite state by means of a fluid of accurately known power of action, and under circumstances which permit of the rigorous determination of the exact point when the conversion is accomplished. For example, the amount of iron in a given amount of a ferrous solution can be easily determined by observing how much of a known solution of the purple potassic permanganate will be decolorised by the ferrous solution. The advantages which the volumetric method offers are rapidity, accuracy, and simplicity of manipulation. An analysis can often be completed in as many minutes volumetrically as it would take hours gravimetrically.

The basis upon which the practical application of this method rests is four-fold.

(a) The fundamental decomposition, or initial reaction, of the analysis in question must be fixed and invariable, else no certain results can be obtained. Not a few proposed processes have failed to satisfy this requirement.

(b) It is necessary to have standard (volumetric or titrated) test solutions, i. e. solutions of accurately known strength. These solutions are prepared either (1) by dissolving a weighed quantity of the reagent in a definite volume of water, e. g. all the officinal solutions, except the volumetric solutions of soda, and hyposulphite of soda; or, (2) by first preparing a suitably concentrated solution, determining its exact strength by a series of experiments, and then diluting it to the proper volume, e. g. the volumetric solution of soda.

(c) A graduated delivery tube, or burette, for measuring the volume of the test liquid required. Of the different kinds, Mohr's clamp burette is very convenient, and is now in general use. The burette is usually constructed to hold 1000 grain-measures of the solution up to the zero mark. A grain-measure is the volume of a grain of distilled water.

(d) The final reaction, or indicator must be known, i. e. the evidence of the completion of the intended decomposition. This always consists in some *visible* change, and is manifested (i.) as a change of colour, e. g. action of acids and alkalies on litmus; (ii.) by the cessation of the formation of a precipitate, e. g. estimation of bromide of potassium and arseniate of sodium by nitrate of silver; (iii.) by incipient precipitation, e. g. estimation of hydrocyanic acid by nitrate of silver; and (iv.), by the use of particular reagents, e. g. in the estimation of fer-

rous salts by bichromate of potassium, red prussiate of potash is employed as the indicator.

The different volumetric methods are conveniently grouped under three heads :

I. Analysis by saturation or neutralisation, i. e. in which the quantity of a base (alkalimetry) or an acid (acidimetry), is measured by the quantity of acid or base, respectively, which is necessary to convert it into a neutral salt. The indicator used in this case is litmus, and the general method of procedure is as follows:—Weigh or measure the necessary quantity of the substance, dilute, add a sufficient amount of litmus, and run in the acid (or alkaline) test solution from the burette until a permanent red (or blue) tinge begins to appear.

II. Analysis by oxidation or reduction, i. e. a substance which will take up oxygen is brought into solution and estimated with a substance of known oxidising power, or *vice versa*. In other words, the quantity of the substance to be determined is found by the quantity of chlorine, iodine, or oxygen to which it is equivalent as an oxidant, or which it requires to pass from a lower to a higher stage of oxidation, e. g. the action of iodine on sulphurous and arsenious acids.

III. Analysis by precipitation, the principle of which is either—

(a) Add the test solution until no further precipitate occurs, e. g. the estimation of bromide of potassium by nitrate of silver, or,

(b) Add the test solution until a permanent precipitate begins to form, e. g. the estimation of hydrocyanic acid by nitrate of silver.

The following general statement will explain the simple calculation required in any given case:—

If  $n$  = the number of grain-measures of the test solution used in a particular experiment, and  $a$  = the weight of the substance tested, which corresponds to 1000 grain-measures of the standard solution—always a known quantity—then, by simple proportion,

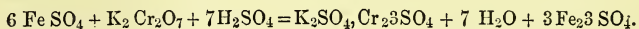
$$1000 : n :: a : x \text{ (the quantity sought).}$$

With this introduction the special uses of the different officinal solutions will now be briefly explained, and an illustrative example of each process worked out.

VOLUMETRIC SOLUTION OF BICHROMATE OF POTASH.  $K_2Cr_2O_7 = 295$ .—1000 grain-measures contain  $\frac{1}{10}$  molecule = 14.75 grs.

Use.—This solution is used only for estimating the amount of *ferrous* salt in the preparations of iron, and was introduced for this purpose by Dr. Penny, of Glasgow. The bichrome is easily obtained pure, and the solution is quite permanent.

*Procedure.*—The iron compound, whatever it may be, is dissolved in excess of dilute hydrochloric acid,\* and the standard bichrome solution is immediately † dropped in until the whole of the ferrous is converted into ferric salt, which is known when a minute drop of the liquid to be tested, placed in contact with a drop of a very dilute solution of *red* prussiate of potash on a white plate, ceases to strike with it a blue colour. The bichrome, it need hardly be said, has no action upon ferric salts. From the amount of bichrome solution consumed, the quantity of ferrous compound is readily calculated from the following data:—One molecule of bichrome ( $K_2Cr_2O_7$ ) is known to contain three atoms, and no more, of available oxygen, i. e. oxygen which it will give up to other bodies. But since  $2 FeO + O = Fe_2O_3$ , it follows by analogy that two molecules of any ferrous compound *plus* one atom of oxygen will be converted into its corresponding ferric compound, i. e.  $n$  atoms of oxygen will peroxidise  $2n$  molecules of ferrous salt. Therefore, one molecule of bichrome will peroxidise six molecules of any ferrous compound whatever, and the fundamental reaction is typified by the following equation:—



Now the volumetric solution of bichrome contains, for convenience,  $\frac{1}{10}$  of a molecule of  $K_2Cr_2O_7$ , i. e.  $14.75$  grs. ( $\frac{295}{20}$ ), in  $1000$  grain-measures, the capacity of the burette, which quantity therefore will exactly convert  $\frac{1}{10}$  of six molecules of ferrous salt into ferric salt.

*Example.*—Ferri Oxidum Magneticum is a mixture of ferrous oxide,  $FeO$ , with ferric oxide,  $Fe_2O_3$ . To determine the precise amount of ferrous oxide, dissolve a suitable quantity, say  $20$  grs., in hydrochloric acid, and add the standard solution of bichrome until the iron is all peroxidised. It will be found that  $230$  grain-measures are required.

The molecular weight of  $FeO = 72$ , which  $\times 6 = 432$ , and this  $\div 20 = 21.6$ . Then,  $1000 : 230 : : 21.6 : x = 4.96$  grs. of  $FeO$  in  $20$  grs. of magnetic oxide, =  $24.84$  per cent.

**NOTE.**—Permanganate of potassium ( $KMnO_4$ ) is also often employed in an analogous way for the estimation of iron by Margueritte's process.  $2 KMnO_4$  or  $K_2Mn_2O_8$  yields five atoms of available oxygen, and will therefore peroxidise ten

\* The presence of free acid, hydrochloric or sulphuric, is necessary, as otherwise a basic compound of chromium would be precipitated, and the oxidising action interfered with.

† So as to avoid absorption of oxygen from the air.

molecules of any ferrous compound. The permanganate is added so long as its purple colour is destroyed, and the only case in which this reaction is utilised in the Pharmacopœia is in testing the purity of Potassæ Permanganas.

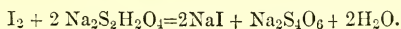
The bichrome solution is used in determining the proportion of protoxide of iron in the following preparations :—

Ferri Arsenias	20	grs. = 170	grain-measures of vol. solution.
„ Carb. Sacch.	20	„ = 208	„ „ „ „
„ Oxid. Magn.	20	„ = 230	„ „ „ „
„ Phosphas	20	„ = 250	„ „ „ „

VOLUMETRIC SOLUTION OF HYPOSULPHITE OF SODA.  $\text{Na}_2\text{S}_2\text{H}_2\text{O}_4 \cdot 4\text{H}_2\text{O}$   
= 248. 1000 grain-measures contain  $\frac{1}{10}$  molecule = 24·8 grs.

*Uses.*—This solution is used in the direct estimation of iodine, and in the indirect estimation of chlorine (chlorimetry) in several chlorinated preparations. Free chlorine cannot be estimated by hyposulphite, because, instead of tetrathionate of sodium, sulphate of sodium is formed; but chlorimetry is indirectly effected (Bunsen's method), by first adding an acid to the chlorinated compound to liberate chlorine, then adding excess of iodide of potassium, whereby for each atom of chlorine present an atom of iodine is disengaged and dissolves in the excess of the potassic iodide, and finally, titrating the liberated iodine. Hyposulphite has no action upon iodide of potassium.

*Procedure.*—The colourless solution of the hyposulphite is added to the solution of iodine until the red colour is completely discharged, or, if starch have been used as indicator, until the blue iodide of starch is decolorised. From the amount of hyposulphite used the quantity of iodine or chlorine is readily calculated. The fundamental reaction is—



Colourless iodide and tetrathionate of sodium are formed. Therefore, since two molecules of hyposulphite = 2 atoms of iodine,  $\frac{1}{10}$  molecule of hyposulphite =  $\frac{1}{10}$  atom of iodine, i.e. 12·7 grains.

*Example.*—The atomic weight of iodine = 127, and accordingly 12·7 grains of iodine should if pure, require for complete discoloration exactly 1000 grain-measures of the vol. solution of hyposulphite.

This solution is used for testing the following substances :—

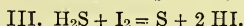
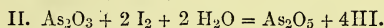
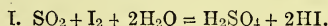
Calx Chlorata . . . . .	10	grs. = 850 grain-measures.
Iodum . . . . .	12·7	„ = 1000 „ „
Liq. Calcis Chlor. . . . .	60	„ = 500 „ „
„ Chlori . . . . .	4·39	„ = 750 „ „
„ Sodæ Chlor. . . . .	70	„ = 500 „ „

VOLUMETRIC SOLUTION OF IODINE.  $I = 127$ . 1000 grain-measures contain  $\frac{1}{10}$  atom of  $I = 12·7$  grs. Iodide of potassium is employed in the preparation of this solution, simply because it is the best solvent of iodine; it exerts no chemical action upon the substances to be estimated by the iodine.

*Use.*—This solution is used for the estimation of arsenious and sulphurous acids, and sometimes of sulphuretted hydrogen.

*Procedure.*—The vol. solution is dropped from the burette into the liquid to be tested, to which a little starch has previously been added, until free iodine begins to appear in the liquid, as evidenced by a permanent blue colour. The solution of sulphurous acid must be considerably diluted before being tested, and the arsenical solutions must be first rendered alkaline by bicarbonate of sodium.

The fundamental reactions upon which the different estimations depend, are—



The third reaction is not applied in the Pharmacopœia.

Now the molecular weight of  $\text{SO}_2 = 64$ , and the molecular weight of  $\text{As}_2\text{O}_3 = 198$ ; therefore since 2 atoms of iodine = 1 molecule of sulphurous anhydride,  $\frac{1}{10} I = \frac{1}{20} \text{SO}_2$ , i. e. 3·2 grs.; and since 4 atoms of iodine = 1 molecule of arsenious anhydride,  $\frac{1}{10} I = \frac{1}{40} \text{As}_2\text{O}_3 = 4·95$  grains.

In estimating the following substances—

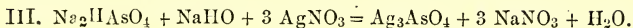
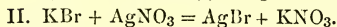
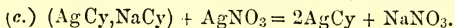
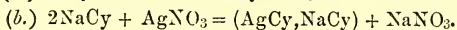
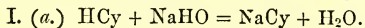
Acidum Arseniosum . . . . .	4	grs. = 808 grain-measures.
„ Sulphurosum . . . . .	34·7	„ = 1000 „ „
Liq. Arsenicalis . . . . .	441·5	„ = 808 „ „
„ Arsen. Hydr. . . . .	441·5	„ = 808 „ „

VOLUMETRIC SOLUTION OF NITRATE OF SILVER.  $\text{AgNO}_3 = 170$ .—1000 grain-measures contain  $\frac{1}{10}$  of a molecule = 17 grs.

*Uses.*—This solution is used in the quantitative estimation of three substances, viz. hydrocyanic acid, arseniate of sodium, and bromide of potassium, but may be applied likewise to the estimation of chlorides and iodides. It is also employed officinally in the detection of fousel oil or aldehyd in spirit of wine (see *Spiritus Rectificatus*).



The fundamental reactions upon which the processes depend are—



*Procedure.*—For hydrocyanic acid (Liebig's method).—Add excess of Liquor Sodæ to the acid (equation *a*), and drop in the silver solution until a *permanent* precipitate of cyanide of silver begins to form. The reason that no permanent precipitate forms at first, although cyanide of silver is insoluble, is this: So long as any free cyanide of sodium remains in the solution a *soluble double cyanide* of silver and sodium is formed, by equation (*b*), but so soon as all the cyanogen is thus combined, the next drop of nitrate of silver in excess decomposes this double salt, and a permanent precipitate of cyanide of silver is formed, by equation (*c*). Now the molecular weight of  $\text{HCy} = 27$ , but since one molecule of  $\text{AgNO}_3 =$  two molecules of  $\text{NaCy}$ , (see equation *b*), i. e. two molecules  $\text{HCy}$  (or  $27 + 2 = 54$ ),  $\frac{1}{10}$  of a molecule of  $\text{AgNO}_3 = \frac{1}{20}$  of  $\text{HCy} = 2.7$  grs.

For any given case then,  $1000 : n :: 2.7 : x$ .

For bromide of potassium.—Dissolve in water and add the standard silver solution until, after agitation of the liquid and subsidence of the precipitate, a drop of the test solution ceases to cause further precipitation. The molecular weight of  $\text{KBr} = 119$ , therefore since one molecule of nitrate of silver = 1 molecule of bromide of potassium,  $\frac{1}{10} \text{AgNO}_3 = \frac{1}{10} \text{KBr} = 11.9$  grs.

For arseniate of sodium.—Expel the water of crystallisation by heating to  $300^\circ \text{F}$ ., so as to obtain a definite anhydrous salt ( $\text{Na}_2\text{HAsO}_4$ ), convert into neutral arseniate by adding a little of the vol. sol. of soda, and then drop in the silver solution until after agitation of the liquid and subsidence of the precipitate a drop of the test solution ceases to cause further precipitation. The molecular weight of  $\text{Na}_2\text{HAsO}_4 = 186$ , therefore since three molecules of nitrate of silver = 1 molecule of arseniate of sodium,  $\frac{1}{10} \text{AgNO}_3 = \frac{1}{30} \text{Na}_2\text{HAsO}_4 = 6.2$  grs.

In testing the following substances—

Acidum Hydrocyanicum	270 grs. = 1000 grain-measures.
Potassii Bromidum	10 „ = 840 „ „
Sodæ Arsenias (dry)	10 „ = 1613 „ „

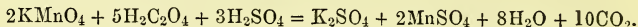
VOLUMETRIC SOLUTION OF OXALIC ACID.  $\text{H}_2\text{C}_2\text{O}_4, 2\text{H}_2\text{O} = 126$ .—1000 grain-measures contain half a molecule = 63 grs.

*Use.*—This solution is used in the Pharmacopœia only for the estimation of bases (alkalimetry), principally salts of potassium, sodium, and ammonium. Because oxalic acid is dibasic, and the bases to be determined by it are mostly

*X* should be  $\frac{1}{5}$  of  $\text{HCy} = 5.4 \text{ grs.}$

monobasic or univalent, it is more convenient to dissolve half the molecule of oxalic acid in the standard volume of 1000 grain-measures.

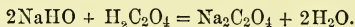
NOTE.—Oxalic acid is also employed in volumetric analysis for standardising solutions of permanganate of potassium :—



Weigh the substances before and after the operation ; the loss of weight =  $\text{CO}_2$  expelled, and  $5\text{CO}_2$  = one molecule of  $\text{KMnO}_4$ .

*Procedure.*—Add a little litmus to a weighed quantity of the basic substance, diluted or dissolved, and run in the standard acid from the burette cautiously until the last drop turns the liquid red.

The fundamental reaction of this process is typified by the following equation :—



That is, 1000 grain-measures of the acid (containing  $\frac{1}{2}$  a molecule) will neutralise one molecule of any monobasic substance, or half a molecule of a dibasic compound. For example, it is stated in the Pharmacopœia that one ounce of *Liquor Potassæ* (= 462·9 grs.) requires for neutralisation 482 grain-measures of the standard acid, and that this corresponds to 5·84 per cent. The molecular weight of KHO is 56, then,

$$1000 : 482 : : 56 : x = 26·9 = 5·84 \text{ per cent.}$$

Carbonic acid turns litmus purple, and therefore in testing alkaline carbonates the standard acid solution is allowed to drop in until the well stirred liquid assumes a purple tint (due to the liberated carbonic acid) ; the solution is then *gently* warmed to promote the escape of the carbonic acid gas, and more acid is added until the last drop of acid turns the solution red.

In testing compounds of lead and lime the indicator consists in the cessation of the formation of a precipitate, because the oxalates of lead and calcium are insoluble.

The caustic alkalies and their carbonates are never met with in commerce in a state of absolute purity, and usually contain from 90 to 98 per cent. of the pure compound.

The tartrates of potassium, citrate of potassium, and Rochelle salt, are estimated volumetrically by first converting them into their respective carbonates by ignition, and then adding the standard acid. One molecule of neutral tartrate of potassium, and two molecules of acid tartrate of potassium, yield one molecule of carbonate of potassium when calcined ; and two molecules of Rochelle salt (tartrate of potassium and sodium) yield one molecule of carbonate of potassium

and one molecule of carbonate of sodium. Under the same circumstances, two molecules of citrate of potassium yield three molecules of carbonate of potassium.

The following substances are tested with the vol. solution of oxalic acid.

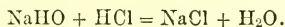
Ammoniæ Carb.	59 grs. = 1000 grain-measures.		
Borax . . . . .	191 „ = 1000 „ „		
Liq. Ammon. . . .	85 „ = 500 „ „		
„ „ Fort. . . .	52·3 „ = 1000 „ „		
„ Calcis . . . .	4380 „ = 200 „ „		
„ „ Sacch. . . .	260·2 „ = 254 „ „		
„ Plumbi Subacet.	413·3 „ = 810 „ „		
„ Potassæ . . . .	462·9 „ = 482 „ „		
„ „ Efferv. . . .	4380 „ = 150 „ „		
„ Sodæ . . . .	458 „ = 470 „ „		
„ „ Efferv. . . .	4380 „ = 178 „ „		
Plumbi Acetas . .	38 „ = 200 „ „		
Potassa Caustica .	56 „ = 900 „ „	If pure = 1000	
Potassæ Bicarb. .	50 „ = 500 „ „		
„ Carb. . . .	83 „ = 980 „ „		
„ Citras . . . .	102 „ = 1000 „ „		
„ Tartras . . .	113 „ = 1000 „ „		
„ „ Acida . . .	188 „ = 1000 „ „		
Soda Caustica . .	40 „ = 900 „ „	If pure = 1000	
„ Tartarata . .	141 „ = 1000 „ „		
Sodæ Bicarb. . .	84 „ = 1000 „ „		
„ Carb. . . .	143 „ = 960 „ „		

VOLUMETRIC SOLUTION OF SODA.  $\text{NaHO} = 40$ .—1000 grain-measures contain one molecule, i. e. 40 grs.

*Use.*—This solution is used for the estimation of acids (acidimetry).

*Procedure.*—To a weighed quantity of the acid dissolved in water, or diluted if necessary, add some infusion of litmus, and cautiously run in the standard soda solution until the last drop turns the solution blue.

The fundamental reaction of this process is represented by the following equation:—



Therefore, 1000 grain-measures of the soda solution (containing one molecule of soda) will neutralise one molecule of any monobasic acid (hydrochloric, nitric, or acetic); half a molecule of any dibasic acid, e. g. tartaric or sulphuric; and one-third of a molecule of any tribasic acid, e. g. citric.

In delicate experiments turmeric may be used as the indicator instead of litmus, especially because some neutral salts, as acetates, citrates, and tartrates, exercise a slight alkaline action upon litmus.

*Example.*—Under Acid. Hydrochlor. Dil. it is stated that six fluid drachms require for neutralisation 1000 grain-measures of the standard solution of soda, and that this corresponds to 10·58 per cent. The molecular weight of hydrochloric acid = 36·5, therefore the 1000 grain-measures of soda solution = 36·5 grains of HCl. But the six fluid drachms of the dilute acid weigh 345 grains, consequently—

$$345 : 100 :: 36\cdot5 : x = 10\cdot58 \text{ per cent.}$$

This solution is used in testing the following substances:—

Acetum . . . . .	445·4	grs. =	402	grain-measures.
Acidum Acet. . . . .	182	„ =	1000	„ „
„ „ Dil. . . . .	440	„ =	313	„ „
„ „ Glac. . . . .	60	„ =	990	„ „
„ Citricum . . . . .	70	„ =	1000	„ „
„ Hydrochlor. . . . .	114·8	„ =	1000	„ „
„ „ Dil. . . . .	345	„ =	1000	„ „
„ Nitricum . . . . .	90	„ =	1000	„ „
„ „ Dil. . . . .	361·3	„ =	1000	„ „
„ Nitro-Hydr. Dil. . . . .	352·4	„ =	920	„ „
„ Sulphuricum. . . . .	50·6	„ =	1000	„ „
„ „ Arom. . . . .	304·2	„ =	830	„ „
„ „ Dil. . . . .	359	„ =	1000	„ „
„ Tartaricum. . . . .	75	„ =	1000	„ „

## Chemical Rules in relation to Prescribing.

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THE subjoined rules will be found useful as guides in prescribing, and taken in connection with Berthollet's laws, they furnish the key to all the ordinary cases of chemical incompatibility.

### BERTHOLLET'S LAWS.

Law I.—Two bodies, in solution, will mutually decompose each other, if it be possible, by double decomposition (i. e. mutual exchange of corresponding radicals) to produce a new body less soluble than either of the two original substances.

Law II.—Two bodies, when heated together, will mutually decompose each other, if it be possible, by double decomposition, to produce a new body more volatile than either of the two original substances.

Most decompositions which occur at temperatures below  $212^{\circ}$  F., take place in accordance with the first law; at higher temperatures, with the second law.

### RULES FOR SOLUBILITY.

1. All metallic oxides and sulphides are insoluble in water, except the alkalis (K, Na, L,  $\text{NH}_4$ ) and alkaline earths (Ba, Sr, Ca). Some of the oxides insoluble in water are soluble in the caustic alkalis, fixed or volatile. Thus, oxide of silver is soluble in ammonia; the oxides of aluminum, antimony, and lead are soluble in the fixed alkalis; and oxide of zinc alone is soluble both in ammonia and in the fixed alkalis.

2. All neutral\* nitrates, nitrites, chlorates, and acetates, are soluble in water.

3. All neutral phosphates, phosphites, arseniates, arsenites, and carbonates are insoluble in water, except those of the alkalies (K, Na,  $\text{NH}_4$ ). The lithia salts are very sparingly soluble. The acid salts of these groups are usually soluble in water.

4. All neutral sulphates are soluble in water, except those of barium, strontium, and lead. Sulphate of calcium requires about 500 parts of water to dissolve it. Some sulphates are decomposed by water, and leave an insoluble basic (sub) sulphate (see Hydrargyri Sulphas).

5. All chlorides and bromides are soluble in water, except chloride and bromide of silver, and subchloride (i. e. calomel) and sub-bromide of mercury. The subchloride and sub-bromide of copper, and the chloride and bromide of lead, are very sparingly soluble.

The number of insoluble iodides is greater than that of chlorides or bromides.

#### RULES FOR VOLATILITY.

1. All inorganic bases are non-volatile, except ammonia. A few of the natural vegetable bases (alkaloids) are volatile, e. g. conia and nicotia. Therefore, in conformity with Berthollet's second law, a volatile base can be liberated from one of its compounds by heating the latter with a more fixed base, e. g. potash (see Conii Folia, Tabaci Folia, and Ergota).

2. Of the ordinary inorganic acids, phosphoric and sulphuric are the least volatile.

Sulphuric acid is commonly employed in the preparation of volatile acids (e. g. Ac. Hydrochlor.; Ac. Nitricum; Ac. Hydrocyan. Dil., &c.)

\* These rules do not apply to acid or to basic salts, e. g. Bismuthi Subnitrates is insoluble in water.



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# I N D E X

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## C O M M E N T A R Y

## ON THE

## B R I T I S H P H A R M A C O P Œ I A.

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